UTILIZING A.R.I.E.L., AGRICULTURAL RESOURCES INTELLIGENT EDUCATIONAL LECTURER, IN THE FORMATIONAL STUDY OF UNDERSTANDING BEFORE AND AFTER PERCEPTIONS OF AGRICULTURAL INDUSTRY LEADERS AND REPRESENTATIONAL CONSUMERS IN AN APPLIED CONVENIENCE SAMPLING

A Thesis

by

COLTON ALLEN ATKINS

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Chair of Committee,	Tracy Rutherford
Committee Members,	Scott Cummings
	Jeff Savell
	Chris Skaggs
Head of Department,	Jack Elliot

August 2014

Major Subject: Agricultural Leadership, Education, and Communications

ABSTRACT

This thesis aimed to determine where agricultural information was acquired by individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments. It also aimed to determine adoption attitude towards utilizing a new media form to acquire agricultural information.

Research sought to identify the most common information sources used to obtain agricultural data. Evaluation of sources used to obtain agricultural data allows identification of foundations, links, and gaps from an individual's perspective on inquiring about production agriculture. Also, this study sought to survey individual's reaction and any possible perception change to using an online information source to obtain agricultural data. Observing reaction and perception change allowed for assessment of retention and engagement.

A descriptive, convergent parallel mixed-methods design was employed to identify self-reported, commonly used information sources used to gather information about production agriculture. Quantitative research questions sought answers to identify knowledge levels compared to non-agriculturally minded consumers, commonly used information sources for knowledge acquisition, engagement with agricultural events and technology adoption characteristics. Research questions addressed through qualitative methods focused on individual's use of an online information source and any possible perception change towards information provided.

This study found that there were no strong reportable differences between the two groups in use of information sources or reaction towards an online information source. Even though group averages were not extremely different, the results did not show any real direction to one source of commonality. Any differences discovered turned out to be small. The same applied to research findings and added to the problem of trying to find a common information source.

Overall, results presented were not representational of the entire study population due to low response rates. As such, no conclusions could be made from this study. This thesis recommends that further study of information sources, new technology, perception changes, and tools used to acquire agricultural information be further studied.

Dedicated to my Grandpas (Atkins and Brinkmann)

and Family (Immediate and Extended).

Thank you all for everything.

I love you all so very much.

ACKNOWLEDGEMENTS

First off, I would like to thank my committee chair, Dr. Tracy Rutherford, for sticking with me for so long. I know I can be a handful and I appreciate you putting up with me. I would also like to thank my committee members, Dr. Jeff Savell and Dr. Scott Cummings for their guidance and support throughout the course of this research. Along with this, I would like to thank Dr. Jeff Ripley for taking time to be a sub during my thesis defense.

I would also like to thank Dr. Skaggs for just about everything. Words cannot describe how grateful I am that you took me under your wing. You will always be a one of a kind mentor and I could not ask for more.

I would also like to say thank you to Mr. and Mrs. Stone for giving me the tools and knowledge to reach this point in my life. Without y'all in my life I may never have obtained this amazing path.

Lastly, this thesis would not be possible without all of the motivation, support, guidance and time from every friend, relative and acquaintance in my life.

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CHAPTER I

INTRODUCTION

Agricultural media is in a continual state of change. As the main scope of agriculture evolves, a new age of agricultural communication is said to be unfolding with it (Doerfert, Evans, Cartmell, & Irani, 2007). While agriculture in the United States, continues to primarily be a production-based industry, there has been a recent rise in scientific and technology-based agricultural pursuits for those involved in production of food and fiber (Cummings, 2005; Michigan Farm Bureau, 2001). Modern agriculture has developed into a more complex, and advanced state. Agriculture, as a living industry, has expanded to encompass broader sectors such as natural resources, environmental and economic sustainability along with nutrition and health (Roberts, 2010). However, it is still unique among major industries because it involves the addition of value to raw materials through the husbandry of living organisms (Plant, 1993). It is a vast, complex system composed of various pathways used to generate value-based products. As this environment-induced complexity grows, the agriculture enterprise becomes exacerbated by an ecosystem of numerous plant and animal species (Plant, 1993). With growth, communication begins to transform and place into perspective agricultural system data for readers, listeners, and viewers (Roberts, 2010).

Agriculture is a biological system. A biological system can be considered an entity with a set of input and output parameters interacting with one another (Goedseels, Randall, Schofield, van der Stuyft, & Wambacq, 1991). The biological system is a

representation of the environment within which agriculture is formed. Understanding whereabouts of those agriculture system parameters is necessary to integrate information that results from its complex structure. Integration of agriculture's mass amounts of information could provide readers, listeners, and viewers with broader means to comprehend the industry. Where, however, does information come from in modern agriculture production and how does it traverse the connections and pathways to individuals? Need to clarify resources for agricultural information to aid in integration becomes pertinent as complex connected-growth of agricultural sectors begins to make lines between systems blur.

Agricultural communication encompasses what is known today as knowledge bases, content of a particular domain or field of knowledge (Cummings, 2005; Wingenbach & Cummings, 2002). Knowledge bases are the foundation information sources are composed of and, in turn, are the agricultural base that provides content of what is taught and disseminated to the public (Cummings, 2005). Though information is derived from set knowledge bases, stages of foundational communication to retention could vary. Retention or learning can be assessed in affective and cognitive domains (Harder, Irani, Lamm, Roberts, & Snyder, 2011). Affective refers to personal learning (Krathwohl, Bloom, & Masia, 1973) whereas cognitive refers to an increase in knowledge and processing skills developed through learning (Bloom et al., 1956). Individual utilization of an information source is based on personal ability to perceive data. Perception in cognitive domains is based on mental organization and interpretation of sensory information (Satish Kumar, Popat, & Kanani, 2008) based on previous

experience and knowledge (May, 1969). Information sources are linkages or connections via communication that affect perception of data. However, an individual's previous knowledge of a subject, ability to adopt a subject (Satish Kumar et al., 2008), socio-economic status (Satish Kumar et al., 2008; Trivedi & Pareekh, 1963), age, education, cosmopoliteness (Meagy, Rashid, Barker, Islam, & Islam, 2013), subject experience (Satish Kumar et al., 2008; Bora, 1986), subject or program participation Satish Kumar et al., 2008; Siddaramaiah & Jalihal, 1983), market orientation (Satish Kumar et al., 2008; Samantha, 1977), economic motivation (Satish Kumar et al., 2008; Moulik & Rao, 1965) and innovativeness (Satish Kumar et al, 2008; Nandapurkar, 1982) can influence their perception. In order to grasp agricultural information sources, it is suggested to understand individuals' attributes to enable the understanding of communication infrastructures used (Lee, Osman, Shiang-Yen, & Wei, 2012). Attributes not only provide understanding, but also determine an individual's use of an agricultural information source.

Agricultural information can be derived from numerous sources interpreted by one's self. Profiling the agri-food sector leads to higher focus on efforts to develop agricultural sources and help articulate concepts, challenges, and opportunities. Increasing profiling creates connections to data involving use of processes to facilitate individual learning from and within the industry (Roberts, 2010; Agriculture and Agri-Food Canada, 2007). Industry learning is considered an active growth process due to learner experience and can result in a permanent change in behavior (Campbell, 1994; Shinn, 1988). Experience should be connected to learning goals of sources as a basic

tool for identification and resolution of dependent problems (Campbell, 1994). Unless an individual knows how a system can work, they are not likely to understand how a system should work (Campbell, 1994; Shinn, 1988). The U.S. agricultural industry is the example system for identification of structure work. It has seen a continuation of low commodity prices due to a continued surplus of agricultural commodities allowing consumers the luxury of low product prices and high-end selection (Cummings, 2005). This industrialized agricultural market structure extends through the entire food system from input supply to farm production, collection, processing, packaging, transportation, and all the way to final consumption of retail food products (Myers, Sexton, & Tomek, 2010). In turn, it creates a market composed of vast interconnected variables of consumer-oriented products.

With rapid advancement, information becomes a key component to consumer-oriented drive and habit. One may view these markets as being based on individuals' understanding, retention, and compulsion to absorb a product. By maintaining rate with changing needs of individuals, industries could provide information to persuade and educate perceptions. Information, as a prominent source of non-tangible currency, can be deemed a pertinent foundation for growth of modern communication progression. By providing common informational sets to individuals, an exchange rate of interest and knowledge could be planted and raised. Ideas based on awareness, conception of thought, and increased retention of concepts may further the exchange of information. It may be presumed that an underlying connection between divided sectors in the agricultural industry could be tied to information. And industries, in a time of data

abundance, must maintain and communicate information as a means to survive in a consumer-oriented world. From this concept the agricultural domain can be seen as an industry in need of common informational source identification and structure to aid farmers, extension workers, researchers, educators, and consumers in data dissemination and retention (Kawtrakul, 2012). Overall, it is here that the rise of a vast, complex industry which individuals create, desire, and interact with brings about a means to evaluate an existence of common information sources used to disseminate and/or gain agricultural data can be seen.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

> It is the task of science, as a collective human undertaking, to describe from the external side, such statistical regularity as there is in a world in which every event has a unique aspect, and to indicate where possible the limits of such description. It is not a part of its task to make imaginative interpretations of the internal aspect of reality. The only qualification is in the field of introspective psychology in which each human being is both observer and observed, and regularities may be established by comparing notes. (Wright, 1935, p. 257-266)

Agricultural markets have changed dramatically within the last few decades as North American food and fiber systems become more economically unified in creating information that better reflects consumer demand and producer supply for more efficient and rapid growth (Vollrath, 2003). Many events have contributed to shaping an the agriculture industry, including rapid pace of technological change, shifts in domestic farm policies, trade agreements, and multilateral trade negotiations (Vollrath, 2003). From these changes integrated markets often benefit society, identify obstacles that continue to constrain markets from functioning more in unison, gauge progress achieved in rendering markets more economically unified, and identify challenges or opportunities

that could deepen agriculture market integration (Vollrath, 2003). With this, agricultural agent activities throughout the food system occurring over space and through time, linked by interregional trade and storage, are subject to risk and uncertainty (Myers et al., 2010). Leading to an important role for information sources from agricultural markets that are a rich source of data (Myers et al., 2010). So what, in broad terms, comprises an agricultural market? Spatial dimension of a market includes transporting commodities from production locations to processing locations and ultimately to final consumers distributed across population centers (Myers et al., 2010). Represented commodity is data in a transportable state. Data and knowledge can be considered location-specific, based on close personal observation and experience generally conditioned by one's socio-cultural context and embedded in value, production, and consumption systems, as well as ways of relating to an environment (Angstreich & Zinnah, 2007; Sillitoe, 1998). Interaction with data that has been transported through the market chain is derived at an environment level. Interaction data becomes increasingly important and, in future agricultural environments, those who grow will be the ones able to acquire accurate, organized information and effectively use it (Holt, 1985).

Perspectives on strengthening agricultural links to the market, stressing investment role of the public and the emerging role of the private sector has been spurred by globalization, increased population, and concerns regarding productivity (Rivera, 2009). Knowledge translation and transfer, a process of converting data into goods, of agricultural data creates links through awareness, communication, and education of individuals (Roberts, 2010; Agri-Food Tech Transfer Network, 2010). Yet, despite

decades of investment and experience with mediums for translation and transfer of data, evidence of impact upon agricultural knowledge, adoption, and productivity remains limited (Aker, 2011). A basis for new orientation towards food generates knowledge and information as a set of organized statements of facts or ideas that have been transformed by the very medium through which they are communicated (Ilcan & Phillips, 2006). Individuals can obtain data from a number of means and members of vast social networks, but while traditional economic theory assumes that it is costless, informational data is still rarely symmetric or costless (Aker, 2011). Modern complexity along with cost of agricultural data stems from its origins. Observation of post-WWII agro-food system appropriation and theorizing in separation of local or indigenous knowledge of food sustained in oral and textual traditions has shown transformation of information into an embedded collective memory as living know-how (Bauman, 2001). Information is a derivative of separate knowledge bases brought together to form a collective state. This has been referred to as an inscription process, wherein information of one is charted and mobilized to become the explicit, universal knowledge of another (Ilcan & Phillips, 2006; Latour, 1987). Here, transference of information develops inscription process. The process is then calculated by means of mapping other people, goods, and places to render them separable from their localities; stabilizing these representations in time and space to keep them "familiar, finite, nearby and handy;" and, translating these facts into combinable products to permit further calculated understanding (Rose, 1994, 2000, 1999). Through which information begins to play an effective role in eliminating or reducing possibility of incurring negative relation to food (Rose, 1994, 2000, 1999).

Understanding basic principle perspectives to agricultural linkage complexities leads to the following question: What is a common composition for agricultural information (data)? To understand what is meant by agricultural information (data) one could first look at understand the meaning of information. The following subchapter is composed of understanding information's basic principles and four main aspects of utilization.

2.2 Information

"The activity of searching for information has become a central activity in our lives." (Cimiano & Sorg, 2012, p. 26)

The word "information" is often used to refer to non-mental, user-independent, declarative (i.e. alethically qualifiable), semantic contents, embedded in physical implementations like databases, encyclopedias, websites, etc., which can variously be produced, collected, accessed, and processed (Floridi, 2005). Information is made from vast organization of concepts interconnected to describe a general interpretation. In a restricted sense, information is that which is conveyed, provided, or represented by a particular arrangement or sequence of facts, that are processed, stored, learned, or transmitted (Floridi, 2005). Information has been defined by the Cambridge Dictionary of Philosophy (1999) as an objective (mind independent) entity. It can be generated or carried by messages (words or sentences) or by other products of cognizers (interpreters). Information can be encoded and transmitted, but information would exist

independently of its encoding or transmission (Floridi, 2005). Information is data that has been processed into a form that is meaningful to the recipient (Floridi, 2005; Davis & Olson, 1985). Data is the raw material that is processed and refined to generate information (Floridi, 2005; Silver & Silver, 1989). Information equals data plus meaning (Floridi, 2005; Checkland & Scholes, 1990). As agriculture field growth increases, general understanding of foundations becomes purposeful as information evolves. The Oxford English Dictionary deems data a substantive, synonym for fact or knowledge imposing it as a thing (Day, 2001). Changing, information is a main theme of related settings naturally intertwined, such as probability, complexity, meaning, coding, and computation (Adriaans & van Benthem, 2008). As a main theme it adapts itself to meet the nature of each setting in any manner. Information for this study is divided into three encompassing categories, four main applied subcategories and five organizing sub-subcategories. Each intermingle together forming a basic information layout.

Information is first divided into three main categories. Over-simplified, these categories are epistemic logic and linguistic semantics, Shannon information theory linked to physics entropy, and Kolmogorov complexity linked to computation foundations (Adriaans & van Benthem, 2008). Categories aim to show how information adapts to its setting of use. The following stances will be touched on briefly to provide a basic description for information.

> Information-A: Knowledge, logic, and what is conveyed in informative answers. [Information stance A is a] logic-based setting [where] an agent can acquire new

> information about what the real world is like, through acts of observation, linguistic communication, or deduction. A simple example would be an agent asking a question, and learning what things are like from an answer. Thus, three features are crucial: agents which represent and use the information, dynamic events of information change, and 'aboutness': the information is always about some relevant described situation or world. [W]e measure quality of information qualitatively in terms of new things agents can truly say.…[T]he formal paradigm for the theory is mathematical or computational logic. (Adriaans & van Benthem, 2008, p. 11)

Knowledge, logic, and convection are all transferable to the mind. Epistemic logic will be viewed as the traditional approach for logic of knowledge (Holliday, 2013). Distribution of information among autonomous agents, transferal of information between agents, and gain or loss of information by agents over time are critical characteristics and computationally can be valuable in analyzing an environment to explicitly represent and reason about the state and dynamics of that environment's information (Davis & Morgenstern, 1983). Traditional stance has led to differing theories about knowledge acquisition and representation. Tying logic to semiotics, one look at the expressive nature of semiotics. Origins of logistics, philosophy, and linguistics come together with Noam Chomsky's description of natural language as a formal system and Richard Montague's grammar description of natural language as an interpreted formal system (Partee & Hendriks, 2011). In Montague grammar, principle

of compositionality, a standard in logic for the meaning of a compound expression is a function of meaning parts (Partee & Hendriks, 2011; Janssen, 1986). This ties logic to linguistics for syntax and semantics (Partee & Hendriks, 2011; Janssen, 1986). However, there are many more identifiers and connections that could be named for understanding full extent of logic and semantics. The previous two introductions, though, provide a basic beginner view of information in logic, knowledge and linguistics. From this point, the next step is to review linguistics and semiotics in semantic form for information provision.

> Information-B: Probabilistic, information-theoretic, and measured quantitatively. [Information stance B deals with] the typical Shannon scenario about a source emitting signals with certain frequencies, say a 'language' viewed as a global text producer, and the information which a receiver picks up from this is measured in terms of expected reduction of uncertainty. This is the sense in which seeing a particular roll of a fair die gives [one] 3 bits of information. No specific agency seems involved here, but the scenario does analyze major features of communication which are absent on the logical approach, such as probability of signals (i.e.,the long-term behaviour of a source, maybe as viewed by the receiver), optimal coding, and channel capacity.... [M]athematical paradigms for the theory are probability theory and physics. (Adriaans & van Benthem, 2008, p. 11)

Information theory, developed by Claude E. Shannon, is based on messages expressed in sequences of letters, selected from a finite alphabet, to construct a sample space of random variables and pi, infinite sequencing of a few information bits, defined accordingly (Yockey, 2005). Information theory is measurable reduction in uncertainty. Information theory concepts are codes, entropy, divergence, redundancy, and mutual information.

First concept considered is codes. Codes are descriptions in information that allow for reproducing a message from one point either exactly or approximately selected at another point *(*Harremoes & Topsoe, 2008; Shannon, 1948). Through coding, an information source is a mechanism which generates elements from a certain set and utilizes a code-book consisting of code-words composed of bits (units of information) as representation related to a source (Harremoes & Topsoe, 2008). In designing codes one main principle exists, compacting codes. Compact coding or compression aims for short code-word lengths in an appropriate way (Harremoes & Topsoe, 2008). This is a basic non-definitive way of coding in information theory that avoids Kraft's Inequality functions, prefix-free property, noise, and detection/correction of errors to create optimal idealized code. Optimal idealized code in information theory leads to entropy.

Entropy is a mathematical function. Introduced by Rudolf Clausius (1865), it is a feature of transformation, or mutability in thermodynamics (Volkenstein, 1912-1992). However, in information it measures and quantifies uncertainty to predict random variable value (Yockey, 2005). Entropy, in a sense, is the minimal average code-word length (Harremoes & Topsoe, 2008). Coded entropy is measured in natural units ("nats")

rather than in bits (Harremoes & Topsoe, 2008). Entropy holds other code expressing keys, but with information variations it cannot work alone.

In utilizing an idealized code and code-word length to represent data, change can occur due to new information being obtained. Redundancy or divergence measures gain in bits obtained by changing to the new idealized code (Harremoes & Topsoe, 2008). Interpretation focuses on a situation starting with partial knowledge and then obtainment of information to make a behavior change (Harremoes & Topsoe, 2008). Divergence is correlated to distribution and can be tied to more bases of Shannon's information theory.

Mutual information measures amount of information, in bits, that can be obtained about an element from another (Harremoes & Topsoe, 2008). Mutual information is divided into three categories; uncertainty removed, average redundancy, and divergence related to change of joint distributions (Harremoes & Topsoe, 2008). Random variable entropy then measures information of something, in that information is always information about something, as the variable itself (Harremoes & Topsoe, 2008). Other information theory aspects are side information causing data reduction, mixing of distributions, and data compression through coding and conditioning. Information theory, as information measuring, is a concept for operational interpretations in engineering, mathematics, and natural sciences.

Overall, Shannon's information theory is based on two fundamental areas, source coding and channel coding. Source coding establishes, on average, a number of bits needed to represent results of an uncertain given by its entropy; whereas channel coding finds reliable communication possible over noisy channels provided rate of

communication is below a certain channel capacity (Shannon, 1948). In brief, short sequences are more common than long sequences and if part of a sequence is missing due to noise then the message should still be understood. Application of a communication system is explained as follows:

> A communication system's object is to accept messages from the source and to transmit them through a channel to the destination as free from errors as the specifications given to the design requirements. The source generates an ensemble of messages written in the finite source alphabet, A. The message is encoded from the source alphabet to the channel alphabet for transmission through the channel. At all stages of the communication the message is acted on by a second chance or stochastic process that interchanges some letters in a random and non-reproducible fashion. The result of this process is called noise. It occurs in all blocks. The ensemble of messages, modified by noise, is received and decoded to the alphabet B at the destination. (Yockey, 2005, p. 33)

Last stance of information is based on Kolmogorov's complexity developed from Shannon's information theory. Through Shannon's theory, Kolmogorov's complexity can be obtained.

> Information-C: Algorithmic, code compression, and measured quantitatively. [Information stance C is] the basic Kolmogorov scenario. We receive a code

> string, and ask for its informational value. The answer is the algorithmic complexity of the string, defined as the length of the shortest program that computes it on some fixed universal Turing machine. While this looks like a totally different setting from the preceding two [stances], there is a direct link to [stance] B. Working with the enumerable set of all 'prefix-free programs', we can easily find an associated probability distribution. In this way, the shortest program for a string becomes an optimal code in Shannon's sense. Thus, the following 'traffic' arises: Information-B starts with the notion of probability as fundamental and derives an optimal code. Information-C starts with the notion of shortest code as fundamental and derives an a priori probability from it. (Adriaans & van Benthem, 2008, p. 11)

Both Shannon and Kolmogorov theories measure object information amount as length of an object description (Grunwald & Vitanyi, 2008). Each information theory deals with differing approaches. Following statement summarizes similarities and differences between them:

> In the Shannon approach...the method of encoding objects is based on the presupposition that the objects to be encoded are outcomes of a known random source. [I]t is only the characteristics of that random source that determine the encoding, not the characteristics of the objects that are its outcomes. In the Kolmogorov complexity approach we consider the individual objects themselves,

> in isolation so-to-speak, and the encoding of an object is a computer program that generates it. In the Shannon approach we are interested in the minimum expected number of bits to transmit a message from a random source of known characteristics through an error-free channel. In Kolmogorov complexity we are interested in the minimum number of bits from which a particular message can effectively be reconstructed. A little reflection reveals that this is a great difference: for every source emitting but two messages the Shannon information is at most 1 bit, but we can choose both messages concerned of arbitrarily high Kolmogorov complexity. Shannon stresses in his founding article that his notion is only concerned with communication, while Kolmogorov stresses in his founding article that his notion aims at supplementing the gap left by Shannon theory concerning the information in individual objects. To be sure, both notions are natural: Shannon ignores the object itself but considers only the characteristics of the random source of which the object is one of the possible outcomes, while Kolmogorov considers only the object itself to determine the number of bits in the ultimate compressed version irrespective of the manner in which the object arose. (Grunwald & Vitanyi, 2008, p. 297)

Relationships and interactions exist between each category. All three categories can be measured quantitatively and qualitatively. Understanding measurability in each opens a look at more in-depth information details. It also can be contextualized in the

four main subcategories philosophy, technical approaches, uses, and sciences/humanities.

History of information originated in a philosophical setting. Classical meaning of information revolved around it as activity or happening (verb), actions being "informed" by the metaphysical or, from the Enlightenment onwards, by powers of reason (Black, 2007; Peters, 1988). In abstract philosophy it is of Latin origin, used by Cicero and Augustine in context of Plato's theory of ideas (Adriaans & van Benthem, 2008). Derived from the Latin word informare (to instruct), it has a long history of being used in the sense of receiving or giving new knowledge (Black, 2007). Information later took a turn from Plato's (eidos) representation in the mind to a Middle Age meaning. During this time, French meaning of information became a cluster of definitions such as investigation, education, and intelligence (Adriaans & van Benthem, 2008). Following this, English translation turned information back to Platonic idea. Information, with progression, sheds new light on classical issues of probability, logic, knowledge, objectivity, representation, and language (Adriaans & van Benthem, 2008). Recent philosophy subcategory development of information has taken a broader range to its base. Philosophy of information may be defined as a philosophical field concerned with: critically investigating the conceptual nature and basic principles of information, including dynamics, utilization, and sciences; elaboration and application of information-theoretic; and computational methodologies to philosophical problems (Floridi, 2008). Philosophy of information transforms itself to encompass and demarcate the overall field.

Information, a polymorphic topic, can be viewed in the subcategory of technical approaches. In the 20th century, information became a subject for mathematical theory, with pioneering work from Ronald Fisher on foundations of statistics (Adriaans & van Benthem, 2008; Fisher, 1925). As such, information takes on mathematical complexity. Stated through the three categories, Shannon and Kolmogorov's information associations are prime examples of information and complexity. Physics can also be tied into these notions with understanding entropy. Along with this, quantitative approaches to information takes broader use than its original meaning. Lastly, communication-oriented information adds to the technical approach by involving study of semantic meaning, knowledge, and other notions that form a domain of linguistics, philosophy, and logic (Adriaans & van Benthem, 2008).

Numerous information uses exist by looking at the setting of use. Informatics is one essential theme utilizing information for learning, simplicity, and belief revision along with epistemic information logics (Adriaans & van Benthem, 2008). Information has also been observed in production activities about computation and information flow, drawing upon recent game-based models of interactive processes, with connections to quantum information flow in physics (Adriaans & van Benthem, 2008). Along with this, bibliometrics and cybermetrics have come to rise in understanding uses of information.

The last subcategory is information in sciences and humanities. Information is used to describe structures and processes of biological and physical world phenomena (Szabo et al., 1999). Various uses exist in computer science (information systems, data structures, and informational actions), physics (utilizing Shannon information and

Kolmogorov complexity), social sciences (communication), artificial intelligence (representation and context) and natural science such as psychology and biology (Adriaans & van Benthem, 2008). To show unique information theory application at look at evolution and the origin of life can be made. In communication, genetics, and molecular biology, interest pertains to long and short sequences (Yockey, 2005). An example of association to sciences are processes of information coding having evolved to meet biological DNA-mRNA requirements of all organisms that ever lived, are alive today and yet to evolve through genetics (Yockey, 2005). Theory of evolution, articulated by Charles Darwin, is a successful paradigm within nature that brings to light the world is changing and in process (Kyle, 2001). Darwin's theory is as follows: I) Variation exists in nature and 2) Because more population grows at a faster rate than does resource availability, competition for resources ensues thereby 3) Advantageous alleles increase in frequency within a population. Over time, allelic frequencies may change so dramatically, a new species is said to evolve (Kyle, 2001). Evolution is a communication system of genetic messages. Random variation within messages was brought about by Gregor Mendel and August Weismann whom tested and hypothesized that variations are changes in DNA of organisms and passed on to progeny (Kyle, 2001). Many other broad principles and theories tied to information exist, but require more precise detailed description. However, the previous was to briefly touch on the way information is transforming in various fields.

Using the connected categories and subcategories opens a way into the five sub-subcategories of information. The five used to categorize information are cognitive,

processing, physical matter, force, and identity (Marchionini, 2010). Each sub-subcategory can be tied together and has been used in the previously stated categories and subcategories.

In cognitive sub-subcategory mental activity and state for neurological and affective means were used. This encompasses origin and usage.

> At a micro level, information in the head is the energy in collections of synapses that are concurrently activated. At a more practical scale, as the mental state argues, information in the head is the set of concepts and relationships active at a given time interval. This condition may arise through introspection and reflection on concepts or events recalled from memory, or it may arise through external stimuli acquired by our perceptual system. The most common sense of information in the head is the mental state that results from an interpretation of an external stimulus, whether from the ambient environment or an information artifact upon which we have focused our perceptual system. An extreme variation on mental state claims that everything external to the human mind is data or signals but information only exists within the human mind. (Marchionini, 2010, p. 11)

Information is then all in the mind. Various notions for informations in the mind as cognitive thought and memory are described in three general classes: information as what we know (cognition that tends to be associated with prefrontal brain activity),

information as how we know, and information as what we feel (emotions and intuitions that tend to be associated with the amygdala) (Marchionini, 2010). The three notions maintain information in a mental manner, but exclude other sub-subcategories.

Mental state alone does not cover all information holds. Processing sub-subcategory acts to inform a perspective of human intentionality and technical developments to amplify communication capabilities.

> One of the original senses of the term information in 14th Century Anglo-Norman language referred to the act of providing evidence about a person. The act of informing is thus a particular kind of communication and over time the term use broadened with respect to the substance of the informing act (e.g., oral or written words) to all kinds of purposes (e.g., teach, advocate). This sense is even broader today to include atomic and biological signaling. [W]e limit communication and the act of informing as a strictly human process. [C]ommunication and the information flow that communication enables from the perspective of who are the participants and what channels are used [is the most basic stance].…[With communication] there are expectations of change in [a] receiver; otherwise, the communication would be ineffective. (Marchionini, 2010, p. 11)

Intent of sub-subcategory is to exchange or receive information. Communication and intent correspond to how information is expressed or executed to provide or receive direct or indirect effects. Information is interaction with a stimuli.

Physical matter sense encompasses artifacts as matter created for communication. Information artifacts are stimuli, means for human-to-human communication. They are either tangible or intangible.

> The most common sense of information in…culture considers information to be the physical objects that are created to express ideas and meaning. Objects such as newspapers, books, and television and radio streams are said to be both informative as well as to be information objects themselves. In this chapter, this physical sense of information as an object that carries meaning is considered from a human-centered perspective with emphasis on how electronic digital artifacts are augmenting the many physical information artifacts that have influenced cultural and economic development over time. (Marchionini, 2010, p. 25)

Artifacts in a classical manner can pertain to historical documentation, but for information becomes broader. Multimedia is an artifact for information.

Force sub-subcategory is energy considered a physical, mental, or social state change. Information is defined as a type of energy that effects change.

[Information energy]…drives learning, comprises plans, and effects changes in Physical or conceptual states. Energy is what effects change in nature at all levels, from the subatomic to cosmic. There are many kinds of energy (e.g., mechanical, electromagnetic, chemical, nuclear, thermal), each with basic properties and measures used to define and study it. Energy can be active (kinetic) or stored (potential), transformed, and measured. We understand energy through the quality and quantity of change it effects. For example, a basic measure of energy is the joule, which combines mass, distance, and time qualities and quantities (a joule is a one Newton force that moves an object one meter; in effect, the amount of force required to accelerate one kilogram one meter in one second on earth.) For informational energy, the qualities and quantities are less well-defined. If we treat reduction in uncertainty as a state change (the work done by informational energy), then probabilities of change can be used as measures for information. For mental or social states, the state change qualities are much more subjective and not (yet) reducible to probability values. One scientific view is that we may be able to determine such values for mental state changes through techniques such as functional magnetic resonance (...mapping [of] word recognition activations in the brain to stochastic functions used in machine learning). Others believe that brain activity is not sufficient to explain mental state change. Likewise, defining and measuring state change in social states (e.g., human recorded knowledge) presents both qualitative and quantitative challenges. (Marchionini, 2010, p. 45)

As stated previously, Shannon information and Kolmogorov complexity apply to force sub-subcategory. Application basis is quantitative measurement of information.

Lastly, identity sub-subcategory is information as proflection of self. Sense emerges from use of Internet and identity of one's own personal being. In recent centuries, and emphatically in recent decades, what has come to the forefront is notion of information as an item (noun) and change of meaning wholly in keeping with increased commercialization, commodification, and identity information use (Black, 2007). Following statement introduced by Marchionini (2010) is used to describe the proflection of identity:

> [T]he evolution of electronic systems has yielded a new kind of information artifact substrate instantiated in the [Internet], and that human adaptations to their ubiquity is defining a new information space for human interactions. This new environment is termed cyberspace and exists between our physical and mental spaces. Cyberspace is populated by people, electronic information artifacts, computational agents (programs), and traces of human activity. Cyberspace has become an instance of collective human knowledge. It is dynamic and more expansive than any single mind or institution can manage. Partitions of cyberspace at any instant in time are new kinds of information artifact. The partition of cyberspace that pertains to an individual represents that person’s identity in cyberspace. Human interactions with others and with computational resources in cyberspace determine alternative expressions of personal identity

> that persist, morph, and propagate as a new kind of information that [is deemed] proflection of self. Proflections represent our personal identities in cyberspace and emerge as the products of our conscious and unconscious actions in cyberspace. They are a product of the myriad collaborations and interactions we have with people and computational agents. These interactions may be intentional or not, and they coalesce into dynamic personal profiles that affect how other people and agents understand us and influence our subsequent activities in both cyberspace and physical space. Increasingly, the boundaries between cyberspace and physical space are blurring, which makes our identities in cyberspace especially important. [The identity sense is the] notion of cyberspace, elaborat[ion] [on the] nature of information interaction, and the importance of personal identity. The concept of proflection is...the combination of different types of projections and reflections...with implications for learning, work, and leisure. (Marchionini, 2010, p. 51)

By taking into account previously stated categories, subcategories, and sub-subcategories establishment can be made of the vast array of information meanings. From information focus turns to the manner of semiotics in terms of pragmatics, semantics, syntactics, social level, and empirics. Following section touches upon semiotics in study relation. Main focus of section is based on semantics as a mean to understanding context of information shown through a textual, online source.

2.3 From Information to Semiotics

> An icon has such being as belongs to past experience. It exists only as an image in the mind. An index has the being of present experience. The being of a symbol consists in the real fact that something surely will be experienced if certain conditions be satisfied. Namely, it will influence the thought and conduct of its interpreter. (Jakobson, 1990, p. 420)

Semiotics is theory of signs. It is concerned with properties, remaining unchanged, of things in their capacity as signs (Barron, Chiang, & Storey, 1999). It is an interdisciplinary field that studies the life of signs within society (Jensen, 2001). Signs can mostly refer to elements of verbal language and other means of communication, but also denote any means of representing or knowing about an aspect of reality (Jensen, 2001). As a result, semiotics has become an influential approach to research on culture and communication particularly since the 1960s (Jensen, 2001). Semiotics is divided into four categories: pragmatics, syntactics, social level, and semantics. Focus on semantics is due to study utilization of a textual, online source. However, it is necessary to touch upon the other four divisions to understand inner-workings of semiotics. These four divisions deal with usage, structures, consequences, and meanings (Barron et al., 1999). Two other divisions have been added to semiotics, physics or physical and empirics (Barron et al., 1999), but avoidance of in-depth due to being beyond the study scope.

Physical is concerned with layer of properties, such as mass, energy, and spatial dimensions that are studied by physical sciences (Helmhout, Jorna, & Gazendam, 2009; Stamper, Liu, Hafkamp, & Ades, 2000). Empirics deals with physical phenomena organized into predictable and recognizable patterns, such as alphabets, which allow reliable reproduction of signals to enable signaling changes that are taking place (i.e. channel capacity) (Helmhout et al., 2009; Stamper et al., 2000). Syntactics (Syntax) is analyzation of relationships among signs without regard for relationships between signs and the subjects they are supposed to represent, nor any regard for users and their intent with the signs (Barron et al., 1999). Syntactics, on sentence level, is the structure of words (verbs, adjectives, nouns, etc.) to form sentences. By combining physical, empirics, and syntactics, an infrastructure is created for the other three layers by showing how signs are organized, expressed, and physically represented (Helmhout et al., 2009). The other three divisions show function of signs for communicating meanings and intentions, along with social consequences to using signs (Helmhout et al., 2009). All of these divisions can be analyzed independently, but still be related. Aside from semantics, pragmatics and social level will be briefly touched on to make a jump from semiotics to cognitive science.

Semantics deals with relationship between signs and the objects to which they are applicable (Barron et al., 1999). Example for use is words or textual content. Words hold a thorough background explaining obtainment meaning and intent for supplying a textual, online source. Semantics is a course of determining such meaning and intent so as to grasp further concepts presented.

Process for comprehension begins with representation of language. Semantics is a base for this purpose. Substantial study of semantics in a variety of fields holds evidence that it can be ordained as study of meaning (Reimer, 2010). Though meaning is a term used in everyday language pertaining to something's true nature it is not as finite as may considered. Meaning can be seen as a vague term holding many areas that form its own self. In comprehending meaning, nature of the word (via the English language) can be broken into three areas; psychology, referents, and language (Reimer, 2010). To take into account these three sectors, a starting point could be analysis of each sector as they intermingle. Observation begins with psychology.

Psychology is conscious and un-conscious, emotional and non-emotional processes leading to speech (language). Psychology can be deemed as production of language or in the case of the semiotic triangle, selector of a referent to language (Reimer, 2010). From this point, direction of the semiotic triangle takes on a parallel standpoint for language and referent. Language or symbol, is perceptible token chosen to express the speaker's intended meaning (Reimer, 2010). Referent is the selected item to the psychology of the speaker. Here it’s noted there is no direct relation between words and the things they stand for, and thus it is only through association in a person's psychology that a word is meant for an object (Reimer, 2010). Breaking away from the semiotic triangle, the next initial concepts to take account are in language.

Language lexemes are a starting point to allow for semantic descriptions. Language lexemes are abstract units, which unite all morphological variants of a single word (Reimer, 2010). An example of a lexeme would be variation words that form a

single word to describe one object, person, etc. From this lexemes take on several unique aspects. A lexeme contains its referent for any one occasion of use, its denotation as the set of all its referents and its sense, which is the abstract general meaning able to be translated from one language to another (Reimer, 2010). Connotation is a fourth aspect used for lexemes, yet does not affect a word's sense (meaning), however it's emotional, euphemistic, or formality of character. Meaning then is compositional, which entails that sentences are composed of meanings of their constituent lexemes (Reimer, 2010). Taking into consideration meanings of words and sentences', two main divisions for semantics can be lexical and phrasal. In relation to human-computer interaction, direct comprehension of lexical semantics (word meaning) is direction of emphasis. In establishment for side notation, phrasal semantics can be described as sentence meaning. Another contrast is that of utterance meaning, which is based on meaning that words have on a particular occasion in a particular context (Reimer, 2010). To bring about understanding, viewing semantic study sentence meaning, and reference to utterance meaning is done. Semantics stems to observe meta-language and object-language as a circular definition that correlates to meaning. As a result, object-language is language whose meanings are being described and meta-language is language which describes said meanings (Reimer, 2010). However, meaning can contain different natures that do not follow the circular notion. One nature of breaking the circular notion is meanings as referent or denotation as the main component of the meaning of a linguistic expression. Second nature to break circular notion is that of meanings as concepts or mental representations. Third nature for break is meaning as brain state or mental synaptic

connections. Fourth nature is that of meaning and use which corresponds to a word's meaning as the way it's used. These four natures can be seen as ways to bring about an explanation of semantics.

A word's meaning is linked to concept of definition. Yet, are definitions important when creating a base for an overall integration of agricultural information? First analyze what a definition henceforth does and provide to the overall uniqueness of this endeavor. Origin of linguistic semantics can start at the mental lexicon. A mental lexicon is a stock of words and meanings stored in long-term memory. Definition of a word is part of the mental lexicon and is a process of matching a meaning with a word-form (Reimer, 2010). Associating a meaning would require to know minimal meaning-bearing unit of the language (for our purposes, English). Words and morphemes can be associated as lowest levels of meaning-bearing objects. Each of these though, could be analyzed due to their non-direct appliance in human language. A word, for starters, can be broken down into either its phonological or grammatical counterpart thus breaking simplicity of wordhood in description (Reimer, 2010). Above and below word level, morphemes, phrasal verbs, and compounds add to the mix for concept of meaning. Consideration of combination of lexemes (words) that supply overall meaning could be accounted for too. When looking at word level it is noted that the higher level of a word forms the phrasal verb and compounds (combinations) and the lower level of the word is the morphemes (Reimer, 2010). Morphemes are broken down to grammatical structure such as sound symbolism or meaning. However, these are just two points to make for basic understanding of meaning in semantics. It is collocation, linguistic context, which

holds further progression to meaning of words. Collocations, although in simplest terms apply to context of the word used, can be broken down by contextual modulation. Context modulation of meaning poses two possibilities to overall meaning of collocations, compositionally or non-compositionally. Compositional meaning can be broken down into a word having the same vague or general meaning in every collocation or the later having a different meaning in every collocation (Reimer, 2010). Non-compositional meaning is opposite onto which there is no general definition with which to follow. Both forms do not hold strength above one another and yet are true to their own problems for linguists to process lexicons.

Definitions hold, at this stage, the problem of determining the most accurate way to define a term or word and thus not logically provide fallacy for argument. Definitions have been observed to be distinguishable between two types of degrees. Before preceding further, definitions and purpose of understanding meaning for formation of an agricultural system, are only meant for setting consistency in a domain of inconsistency and scrutiny. There is no right way to define a term due to vastness of the linguistic field and for the ever-changing process of applying the word defined. Concepts can be concluded, but should not be set in stone. As can be seen, two defining degrees of definitions are real and nominal. A definition can be seen as a summation of the essence or inherent nature of a thing making the definition real or as a description of the meaning of the word which denotes the thing described (Reimer, 2010). This makes it a nominal (Reimer, 2010). Real definitions are not normally used for the purpose of semantics, yet nominal definition has been further broken down into greater detail. Nominal definitions

may be of two types, extensional which is aimed at delimiting the denotation of the word, or cognitive which is aimed to inculcate an understanding of the word's correct use (Reimer, 2010). Nominal cognitive definitions have different modes to which they can be taken as. These modes are definition by ostension, synonymy, context or typical exemplar, or genus and differentia with the latter being most useful for cognitive definition. Genus and differentia is the idea of expressing what something is and what makes it different from other examples of the same sort (Reimer, 2010). As stated previously though, it is nearly impossible to pin down an accurate true definition for the meaning of a word. Numerous errors arise from preceding forms of definitions yet for basic generalization provides an overall idea.

Understanding definition of a word is just one segment of comprehending meaning for semantics. Lexical relation, or comprehension of how a word relates to other words, is another process to determining meaning. Though lexical relation may seem to be a broad distinguishing marker, it can be broken down into five types. Antonymy or oppositeness can be described as a relationship of incompatibility between two terms with respect to a given dimension of contrast whether that distinction be gradable or non-gradable. Meronymy is the relation of a part to a whole. Hyponymy and taxonomy define different types of class-inclusion hierarchies in that hyponymy takes on structural importance in languages and taxonomy holds for biological purposes. Lexical deviations are of apparent usage for understanding semantic meaning and determination of lexical items (Reimer, 2010). Under this categorization description can be formed following the sense of the word used. Words with several related senses are polysemous

contrasted to that of a word where there is a single meaning (Reimer, 2010). Deciphering between these two are, as previous matters of semantics, under discrimination of non-absoluteness. Though each of the defining criteria for words may seem to be non-structured, reporting of basic concepts is a way to bring about awareness for basics of semantics.

Categorization is a means for providing a base work for setting an agricultural system. Categorization in semantics is viewed as important due to human nature to categorize language to experience and objects. There are two main types of categorization in the field of semantics that have taken part in defining meaning. Classical categorization is the two-valued, true or false, approach that views nature of categories to which a definition applies (Reimer, 2010). Though this view of categorizing may hold some solid form, it is improbable due to no in-between cases of property.

Language is a mesh of in-betweens and from here analysis drops the classical categorization form and moves towards the second form of categorization, prototype. Prototype categorization is structured in terms of prototypical or central members that define tendency of a category (Reimer, 2010). Prototype is not perfect in its description of meaning for human language and holds many a question to be considered when discussing. Of several problems, prototyping does not identify relevant attributes in a category. It is broken down as follows: attribute identification depends on category identification, attributes vary with context, and possible alternative descriptions of attributes may exist. Second problem with prototyping may account for category fuzzy

boundaries between categories. Third issue is concerned with scope of prototype categorization in that prototyping deals with visible categories yet questionably justifiable to abstract, non-visual categories. In addition to these preceding issues formulation of definitions are proven difficult due to fuzzy boundaries and objection to prototypes is criticized to metalinguistic belief. At this point, understanding cognitive approaches to semantics has taken on basis of prototyping. Cognitive semantics takes on a unified vision of the place of language with approaches of rejection of a modular approach to language, identification of meaning with 'conceptual structure', rejection of syntax-semantics distinction and semantics-pragmatics distinction (Reimer, 2010). To begin, cognitivists take on the approach for rejection of modularity that language is not an independent module or faculty within cognition yet can be explained through psychological mechanisms as a whole (Reimer, 2010). This idea of a holistic forming of linguistic data allows one to lead into conceptual structure shared by cognitivists. It is then understandable that the domain of linguistic semantics takes on a continued study of the nature of human conceptual structure (Reimer, 2010). Along with a conceptual structure, it is notable that cognitivists reject distinctions between semantics-syntax and pragmatics. These are self-explanatory rejections in that they place no distinction or boundaries between related fields as linguists may presume exist. A central notion in cognitive semantics is now of precedence.

Idealized cognitive models (ICMs) are linguistic meaning depending on encyclopedic knowledge structures stored in long-term memory, which in short, can be summarized as implicit knowledge humans have about objects, relations, and processes

named in language (Reimer, 2010). These knowledge structures involve image schemas that organize structures of human experience and understanding at a level of bodily perception and movement (Reimer, 2010). There are key problems, however, to this. Leading on with conceptualizing in cognitive semantics, conceptual semantics formed by Jackendoff, which inherently links to conceptualization, differs due to use of a formalism (Reimer, 2010). Conceptualization follows similar means to analyzing meaning in language that can be seen throughout. However, Jackendoff makes claims that decomposition method is necessary to explore conceptual structure. Concepts underlying word meaning are broken down to the smallest elements of lexical items filled with syntactic complements (Reimer, 2010). From this concept, linguistic state of words on computers could be established. Lexical representation on a computer has been seen in varying forms. One way is that of the synset. A synset is groupings of near-synonyms, arranged into hyponymic or taxonomic trees referred to as inheritance hierarchies (Reimer, 2010). Within each of these inheritance hierarchies comes defining involved terms. It is noted that in inheritance hierarchies, terms inherit information associated with their hypernyms giving a person immediate access to a full range of information associated with a lexical item (Reimer, 2010). There are word-sense disambiguation problems concerning processing and distinguishing of a lexical item. Two approaches to this issue in the infancy of computer breakthrough are selectional restriction used to take out improperly formed semantic representations and contextual approach used to assess words surrounding the target word for acquisition of appropriate word-sense (Reimer, 2010). Along with these two methods, solving the problem of

word-sense has been discussed by Pustejovsky. Pustejovsky claims that meaning of nouns can be modeled by notion of qualia structure which consists of constitutive, formal, telic, and agentive roles. Pustejovsky also describes event structure, but focus is on qualia and the four elements to its structure. The constitutive role is relation between an object and its constituents or proper parts such as material, weight and/or parts, and component elements (Reimer, 2010). Formal role is that which distinguishes object within a larger domain in association with its orientation, magnitude, shape, dimensionality, color, or position (Reimer, 2010). Telic role is the purpose and function of the object meaning the purpose that an agent has in performing an act or the built-in function or aim that specifies certain activities (Reimer, 2010). Lastly, agentive role describes factors involved in the origin or 'bringing about' of an object such as the creator, artifact, natural kind, or causal chain (Reimer, 2010). These four roles can be used to distinguish a word's meaning on a processing level for understanding. The qualia structure allows for avoidance of postulating a large number of polysemous senses for a one single lexical item (Reimer, 2010). Semantics can be seen on computer level of interaction and role of understanding the basis of linguistics providing a starting point for more development of systems. Human interpretation is vast and ever changing yet to be able to conceive the notion of a base, groundwork for an operational system of intelligence can begin. Linguistic study provides a fundamental advantage for understanding other areas more in-depth such as cognition and interaction. Next is provision of a manner for comprehending cognition to tie together human-computer interaction with agriculture benefits.

Pragmatics is concerned with relationships between signs and behavior (i.e. illocutionary or intended effects) of the agents (Barron et al., 1999; Singh, 2002; Morris, 1938). Traditionally, pragmatics has been considered as forming a triad with syntax and semantics (a partition originally ascribed to Charles Morris, and inspired by ideas from the philosopher Charles S. Peirce), where syntax is considered to be the study of formal relations of one sign to another, and semantics studies relationships between signs and objects in an outside world (Mey, 2006). Pragmatics is thought on a standard of speaker to listener than writer to reader, but the two are similar in channeling a means. Though focused on the semantic Web, progression of semiotics to the web has been occurring. Pragmatic Web has been a recent development focusing on the approaches to creating the Semantic Web, which lie in pragmatics (Singh, 2002). Application of semiotics to the Web helps creating systematically about symbols that constitute it. On the Web, syntax refers to tags (such as HTML or XML tags), semantics refers to what those tags denote (parts inventories), and pragmatics refers to the context-sensitive aspects of meaning (dates and times or processes affecting size) (Singh, 2002). Pragmatics is, on a whole, an area to approach another time. Combination of syntax, semantics and pragmatics takes on a final step, social context, level or consequence.

Social context, level, or consequence (aka Social) is based on the social consequences achieved by the perlocutionary effects (i.e. users performing actions and decisions) of signs (Barron et al., 1999). Social is derived from language, which is of a semiotic system that constitutes a culture (Ryan, 2011). Language is a shared meaning potential which is inherently social, and, in fact, language, as a sign system, actively

symbolizes the social system so that the exchange of meanings is dependent upon the social context and purpose of the exchange (Ryan, 2011; Halliday, 1978). Social level consists of many kinds of norms such as ways of behaving, sets of values, and shared models of reality that define the shape or form of social reality (Barron et al., 1999). Following statement provides an understanding of differences of pragmatics and social:

> Social level, we are concerned with the actual, perlocutionary effects of the signs, whereas at the pragmatic branch, we are interested in the illocutionary or intended effects. For example, each intended task (i.e., illocutionary act) performed by an information system should have social consequences achieved by the users performing actions and decisions (i.e., perlocutionary acts). Then these perlocutionary acts should impact target context. (Barron et al., 1999, p. 5)

By combining these main ideas, results on the semiotic ladder are consequences that occur from point A to point B in the information system (however, semiotics is not as straight forward in that one domain may affect another and vice versa). Semiotics branches into the level of cognition. Overall, semiotics is, in a general sense, a model of signs. Cognition is processing of signs, through sensory input, in the mind.

2.4 From Semiotics to Cognition

> To suppose that the eye, with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest possible degree. Yet reason tells me, that if numerous gradations from a perfect and complex eye to one very imperfect and simple, each grade being useful to its possessor, can be shown to exist; if further, the eye does vary ever so slightly, and the variations be inherited, which is certainly the case; and if any variation or modification in the organ be ever useful to an animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, can hardly be considered real. (Darwin, 2006, p. 337)

Origin of a virtual environment is observable in developing methodologies for information provision. In cognition, there is focus on main areas of achievement to bring about current individual environment interaction. The following is a brief introduction to the development of psychological breakthroughs that bring about basic knowledge levels. Acknowledgement of processing information and human perceptual-motor behavior that individual's exhibit is an initial starting point. This allows for key distinctions and overviews of areas that underlie the interaction with computers.

To understand the interactions that take place among finite material objects in the physical world with the mental realm of the human, a beginning are studies that have transformed psychological thinking. Aim is to put forth set theories that can be used to set a base for human-computer interaction basics. Starting with information processing for humans, this is an approach that describes humans as active processors of information, in terms that are now commonly used to describe complex computing mechanisms (Welsh et al., 2012). An information-processing analysis describes observed behavior in terms of encoding perceptual information, manner in which internal psychological subsystems utilize encoded information, and functional organization of these subsystems to bring forth set behavior (Welsh et al., 2012). In turn, setting the idea that information processing is stimulus identification, response selection, and response programming (Welsh et al., 2012).

Following information processing, perception and its role on motor behavior is reviewed. Performance demands coupled with behavioral motivations may unite a cognitive approach. Understanding the subject may show how perception information processing links to motor skill execution through representations of actions stored in memory. An ecological or dynamical psychology approach may also emphasize immediate environment and task to understand perceptual-motor skill behavior (Hommel, Musseler, Aschersleben, & Prinz, 2001). Perceptual-motor behavior as a whole can be summarized as information capacity of the motor system (Fitts, 1954), the attentional demands of movements (Posner & Keele, 1969), motor memory (Adams & Dijkstra, 1966), and processes of motor learning (Adams, 1971) (Welsh et al., 2012). So

how does information processing and perceptual-motor behavior begin to play a role with computer-human interaction? Initial subject matter starts at what is seen through the eyes to develop a base for retaining knowledge and deciphering the world around.

Perception of an image in atomical values that float among the space on our outer realm can be correlated to a scientific understanding of our adaption for visionary manifestation. In the folding works of an eye and its design, basic building blocks of the workings that take place to perceive an object for comprehension can be used in modern day design principles. Thus, progressing from a stance about the eye and its obtaining nature, a basis may be obtained to begin to understand the rhetorical act of gathering perceptional rhetoric with computer interaction. Following is a brief overview of the eye and the interaction it holds to understanding states of attention on objects for informational processing.

The eye and its structure are a cornerstone achievement of perceptual observation in determining reality around. Forming the process function to deliver neural cognitive responses from the eye's concentration of attention can begin to bring about a definition to understand attention and what is perceived by that attention. With focus of the eye on perceived objects, attention is then a main form of non-unitary functionality in collecting processes that allow individuals to dedicate information-processing capacity to cognitive manipulation of a subset of available information as reception of memory to achieve a level of consciousness (Welsh et al., 2012). Attention can be interspersed between objects as shifts of informational processing. Attention shifts that fluctuate in underlying synaptic methods for visualizing can be attenuated to the retinal surface of the eye and

the two distinct receiving areas known as the fovea and the perifoveal in concerns to photosensitive recognition (Welsh et al., 2012). Breaking down these two main parts, differences are held by each. The smaller of the two areas is the fovea, near the center of the retina containing the highest concentration of color-sensitive cone cells, enabling provision of rich, detailed information used to identify objects (Welsh et al., 2012). Further processing the fovea, its adaptation to the role of object identification can result in the planning of action and other cognitive processes, which in turn corresponds to the direct link of the fovea's size in comparison to the overall proportion of the eye. The fovea's small size results in an inability to focus on a derived detailed representation of the environment from single fixation (Welsh et al., 2012). The eye, in response to this limitation, constantly moves information from objects in the environment on the fovea by accurate rapid rotation known as saccadic eye movements. In turn, these movements are referred to as overt shifts of attention to which the main dedication is for foveal information. Moving into the perifoveal retinal surface, focus is placed on shifts of attention that covertly occur. Any situation in which attention is being dedicated to non-foveated space is considered a covert shift, in which attention is used when an individual wants or needs to maintain the fovea on a particular object while continuing to observe and scan the environment for other stimuli (Welsh et al., 2012). Overt shifts in attention are contrasted by the dedication to foveated areas. Shifts can be driven in part by stimuli or by the will of the individual; in turn, one must distinguish difference between these. Shifts derived from stimuli are deemed exogenous shifts of attention and are considered automatic in nature having been caused by dynamic change in the environment (Welsh

et al., 2012). In contrast, performer-driven shifts, endogenous, are under voluntary control and take longer to develop, though they have the ability to be sustained over much longer periods of time. To summarize endogenous shifts, consider the cue of symbolic representation to bring about change (Welsh et al., 2012).

With shifts undertaken, application is applied to the process of action-centered attention in the tight link between attention and action that covert shifts of attention occur before saccadic eye movements and in turn, that overt shifts of attention are tightly developed to manual aiming movements (Welsh et al., 2012). Progressing these ideas further, applying attention to action processes is provided in the model of response activation developed by Welsh and Elliot (2012). In this model, basis of response activation is formed around premise that attention and action processes are tightly interwoven, so as to understand that dedication to attention to a particular stimulus automatically initiates response-producing processes that are designed and designated to interact with that stimulus (Welsh et al., 2012). Another cornerstone of development with action-centered attention is based on special coordinates of attention in different action contexts, basing initial insight into issues of response efficiency (Tipper, Lortie, & Baylis, 1992). Attention and action are tightly linked, such that distribution of attention is dependent on the action that is or was being performed (Tipper, Lortie, & Baylis, 1992). Overall focus on attention revolves around target engagement with brief previously stated models and theories. Reasons for engaging a target in human-computer interaction tasks are due to the fact that the target symbolically represents an outcome or operation to be achieved and defines an icon as a target, which carries a meaning

defining it as the appropriate target (Welsh et al., 2012). Attention can form an overall ability to perceive the environment and variables around one's self. Attention of information in turn forms and forms from cognitive means.

Human cognition is understood through an integral system involving interaction of three elements: an intrinsic mechanism that operates locally and is actuated in the brain; a global system, culture; and the natural world that individuals and culture operate within and are in continual dialogue (Griffith, 2005). Cognition is a basis of processing in a natural state. A person is an organic, information-processing machine that paradigmatically takes in sensory stimuli (input), performs operations on this input (processing), and behaves in various ways (output) on the basis of this processing (Bergner, 2006). Taking from this input-output behavior, understanding of psychological effects through interaction with object variables is taken into consideration. Considering what objects afford in terms of functional properties, individuals may pick and interact with the object in a way that reflects their understanding of its purpose as well as its composition (Chapman, Rosenbaum, Weigelt, Weiss, & van der Wel, 2012). Interaction with the object then represents motor control coincided with psychological development.

Cognitive science is the interdisciplinary study of the mind's nature (Oberlander, 2006). This paper aims to intermingle the area of scientific cognition with that of philosophical outlooks for a broader scheme of representation. Underlying difference between the two is vastly grey and therefore both terms can be used. Cognition, as will be an encompassing term for meaning of science and philosophy, is comprised of two

central characteristics that represent the core of its self (Abrahamsen & Bechtel, 2012). Core representation allows for a cognition base.

First, cognition is cognitive in that it aims towards empirical and theoretical understanding of human cognition such as intelligence, computers, and linguistics (Abrahamsen & Bechtel, 2012). Second, it is interdisciplinary in that ideas and methods of inquiry spread across boundaries of fields (Abrahamsen & Betchel, 2012). These two characteristics provide a base of cognition as a field of intangible fuzzy links that encompass a broad spectrum of ideas and concepts.

Here the mind to which cognition is concerned about takes on two levels of human representation. First is personal and belongs to common sense as the level people act or behave and have attitudes, emotions, sensations, character traits, and an array of cognitive capacities, such as perceiving, understanding and speaking language, remembering, imaging, and reasoning (von Eckardt, 2012). Second level, in contrast, is subpersonal and scientific as the "information-processing" level of cognitive science, which a person's cognitive mind is theorized to be both a computational and representational system (von Eckardt, 2012). Both levels give way to two uses of Representation Theory of Mind (RTM) in relation to the mind. First use of RTM involved the subpersonal level, stating there are mental representations at this level making it a working assumption about the mind/brain (von Eckardt, 2012). This idea is held by many cognitive scientists (von Eckardt, 2012). Second use, much used by philosophers, is that RTM is a theory about the relationship of the personal to the subpersonal levels, specifically, that propositional attitudes are computational relations

to subpersonal mental representations (von Eckardt, 2012). It is at this understanding that both involve the defining of mental representations. Through initial layout in Peirce's general theory, a representation is constituted by a representation-bearer that presents an object (represented content) where the representing has significance for some interpreter (von Eckardt, 2012). It is mainly a simplistic means to defining representation for common ground. Further detail of particulars for mental representation, observation of underlying meanings of the representation-bearer, represented object (content), and significance that is held will occur.

A representation-bearer is a material or formal property containing content and significance (von Eckardt, 2012). Represented object (content) is the semantic relations for forming multiple objects as one complex object (von Eckardt, 2012). Represented objects can be further broken down when it comes these semantic relations. Further dissection leads to iconic, indexical and symbolic representations (von Eckardt, 2012). General definitions of these three representations are as follows: icons are representations that present the object in being similar to the object in respect; an index is an "existential" relation or real connection between representation and its object; lastly symbols are conventions (von Eckardt, 2012). Overall, the end of the Peirce triadic view is significant. The “interpretant” is whatever makes a representation-bearer's representation of some object significant for an “interpret”. Thus, this is an inner-working in the mind of the interpreter (von Eckardt, 2012). The previous was the simplest explanation of the theory of mental representation, though there are varying degrees from its original meaning. Some may view that significance does not hold true

to representation whereas others add more requirements to the structure at hand such as schemes, and arbitrariness (von Eckardt, 2012). It is however, at the simplest form that leads into more developing content for cognition. Moving along with representation-bearers, cognitive scientists, conceptualizing the mind/brain as, or as substantially like, a computer, take representation-bearers of mental representations to be computational structures or states making representation-bearers data structures (von Eckardt, 2012). Through that association language connects with semantics.

Six main kinds of representation have been produced by Thagard (2012) that complement natural language. Those six are as follows: sentences or well-formed formulae of a logical system; rules; concepts such as frames, schemata, or scripts; analogies; images; and connectionist representations (von Eckardt, 2012). Intertwined with the representation-bearer, cognitivists take into consideration semantics and semantic relations (grounds) for a representational object (content). Here von Eckardt (2012) summarized the role of semantics and their relations for representational content. Von Eckardt (2012) explained that mental representations are semantically selective, diverse, complex, and evaluable, and they are compositional to bring together conclusions about representations formed. One problem with this concept, however, pertains to what about representations exists that gives them content (von Eckardt, 2012)? This problem creates cognitive issues for a common foundation. However, conceptualized work has been established by Peirce into two broad kinds of existing groundwork for representation, similarity and causation (von Eckardt, 2012). These two are embraced by contemporary scientists and have in turn added to the base with a

functional and biological role (von Eckardt, 2012). Representations are challenging for cognitivists. Noting that there is challenge between non-representational and representational theories allows for a representation theory of mind, but only one part of cognitive research. Representations can, as previously seen, tie together semantic research. Never-the-less, it is one bit of knowledge that can lead into the architecture of those representations for cognition.

Cognitive architecture is a generic proposition about representations and processes used to produce intelligent thought for aspects such as problem solving, memory, and learning (Thagard, 2012). It is a fundamental concept for cognitive science. Explanations are, one may perceive, typically mechanistic describing how different kinds of thinking occur as a result of mental explanations that are operated on or by computational procedures changing mental states (Thagard, 2012). Cognitive architecture is a proposal about varying kinds of mental representation and computational procedure constituting a mechanism for explaining a broad range of thinking (Thagard, 2012). Representations are taken into account for dealing with cognitive architecture. Representation exist in architectures. Two main architectures are applied to varieties of human thinking as computational procedures for representations. First are rule-based systems that apply procedures such as forward chaining to if-then representations with word-like symbols (Thagard, 2012). Second are connectionist systems which apply procedures such as parallel activation adjustment to representations comprised of neuron-like units containing excitatory and inhibitory connections between

them (Thagard, 2012). Both have different means to describing the human role of using representations. Here consideration is taken for aspects of foundation cognition.

Cognition can be broken into numerous aspects that encompass overall being of cognitive study. Each aspect holds unique cognitive approaches to mind/brain science. Cognition is a complex combination of perception, action, human learning and memory, reasoning and decision-making, emotion, and lastly, consciousness.

Perception is what humans perceive shapes thinking and guides actions (O'Callaghan, 2012). Yet what is it, and how is it, that humans come to perceive things? Perception is a controversial subject to cognition. Cognitive science explains that sensory stimulation occurs when the environment disturbs a sensory surface, such as the retina, tympanum, skin, olfactory epithelium, or tongue leading to receptive surfaces transducing chemical, mechanical, or electromagnetic energy into neural signals initiating further sensory and sub-perceptual processes (O'Callaghan, 2012). Perception, on a basic scale, is a development of sensory actions leading to internal processes of association with objects. Processes, such as vision, explain images projected by the lens of the eye upon the retina is quite different, two-dimensional and inverted, from what we see (O'Callaghan, 2012). Image perceived moves relative to the retina due to constant eye movements such as saccades and micro-saccades that occur up to sixty times per second (O'Callaghan, 2012). Also, rod and cone receptors, which are sensitive to different wavelengths of light, are distributed unevenly (O'Callaghan, 2012). From the point when the optic nerve departs, the retina image information is lost though humans don’t experience a “blind spot” in vision as a different image strikes each of the two

retinas (O'Callaghan, 2012). The same conceptualized idea of perception can be applied in auditory. Air pressure fluctuations set off intricate vibration patterns at the two eardrums leading to a spatial auditory experience comprising discrete sound streams characterized by discernible audible attributes (O'Callaghan, 2012). Again the same can be said for olfaction when complex mixtures of chemical compounds cause a huge array of recognizable smells (O'Callaghan, 2012). Contemporary establishment of perception has led to understanding processes of information. Information is received through the environment or as unconscious inferences from sensory stimulation. There are numerous theories behind both of these perception causes, yet a combination of the two may be best at holding together a basic idea of perception. The goal is not to establish a detailed literature on these theories, but to create a base. Along with this understanding, another side of perceiving has been invoked concerning incomplete detail of vision for representation and movement association towards vision (O'Callaghan, 2012). These previously stated approaches take on the task of alleviating some issues about how vision and senses explain perception. However, they do not solve all of the issues at hand. A look at phenomenology in which sensory experiences are not part of the equation where mental visualization is formed may help. Phenomenology, however, should not merely be a defining point on perception and is only meant as another outlet to understanding how humans, perceive our surroundings. Perception is a case of universal interpretation and is only one aspect of cognition.

Aspects of cognition range from mental idealism to a physical side of knowledge. Action takes place on a physical range of boundaries for cognition. To begin, the nature

of action lays work for realizing how action is understood through cognitive science. Causal explanations of actions combined with rational explanations can be associated with behavior characterized in terms of certain sort of psychological causal processes (Pacherie, 2012). Causal theory has many approaches. Some may view it as beliefs and desires, while others see intentions, volitions or tryings as elements of study (Pacherie, 2012). Along with these there are three broad types corresponding to processes of an action. These types are based around mental events to bring about certain effects, the nature of causal antecedents and lastly, action as causal process sequences (Pacherie, 2012). Theories and ideas have been formed and argued having aimed to solve causal deviances. Large and small actions are observed as to whether they hold differences in causal approaches. Attempt to explain large and small actions has led to dual-intention theories aiming to understand functions of causal linking bodily behavior (Pacherie, 2012). An underlying need to be able to describe ways of intentions proceed with their functions and nature of their contents bring about use of motor cognition (Pacherie, 2012). Motor cognition, as sensory application was first thought of, took on a meaning of centralism that relayed the idea of internal models. From there motor cognition took on the idea of control structures making use of internal models (inversely or forward) and lastly, hierarchal organization of action (minimal or complex). All stances give solutions to causal deviance and grasp a better representation of action (Pacherie, 2012). Motor execution and action, still hold many areas of further study, such as conscious agency and knowledge of actions and intentions (social cognition). Integrating

knowledge of basic action into an overall understanding of cognition allows for further development.

Memory traditionally holds to three main areas of research: understanding the characteristics of veridical memory, examining constructive and inferential processes that both facilitate and distort memory, and examining using neurobehavioral data to suggest fundamental differences between memory processes or representation (Ranganath, Libby, & Wong, 2012). Through the three traditional views of memory, progressive work has been conducted in order to further examine human memory systems. Branching from these studies, retention of information in short and long-term delays has created distinct interest and theories. In brief, short-term memory has led to the theory of a working memory in which there is a fundamental difference between phonological and visual information retention along with a separation between short-term storage and manipulation of information for service of task goals (Ranganath et al., 2012). Initial research has studied framework levels of processing. Framework demonstrated that different levels could affect memorability of a stimulus (Ranganath et al., 2012). However, it finds many gray areas in recognizing certain aspects of memory in terms of how information is processed during encoding. Collectively with other studies, memory performance depends not only on how information is encoded, but also on interactions between encoding and retrieval (Ranganath et al., 2012). Researchers have built upon these points and have shed light on new approaches to viewing memory and its processes. For instance, distinction between memory processes have led into organized domains of declarative and procedural, in which declarative memory

facilitates the report of specific material and procedural memory supports performance of operations and procedures (Ranganath et al., 2012). Along with these two distinctions, further study of memory processes have been made. Distinction of memory has been broken down into inferential processes. These are used in constructing knowledge schemas, inferences to memory tracing, and attributional memory processes that attribute conscious experience to particular sources (Ranganath et al., 2012). Overall, memory and memory processes are influential in developing a layer of connection interaction that may help with computational devices and how human recollection of dealing with said devices occur.

Cognition takes on broad fields to bring about an understanding how humans possess interaction with thoughts and the world around them. One example of the human/mind field is that of reasoning (utilizing given information to make inferences concerning new information) and decision making (utilizing information to decide what to do) (Oaksford, Chater, & Stewart, 2012). Reasoning takes on two means, deductive (logical) and inductive. Fundamentally, deductive reasoning is if premises are true, then conclusion must be true as opposed to inductive reasoning that makes conclusion merely plausible or probable (Oaksford et al., 2012). These are two basics for understanding reasoning and lay a base for probability theories and logic-based mental models. Moving away from reasoning, decision making is concerned with not how people utilize information, but how people's beliefs and values determine their choices (Oaksford et al., 2012). Decision making holds numerous complexities. Theories have been found to combine broad scenarios to cognitive processes such as learning, motor control, etc.

(Oaksford et al., 2012). Cognition in turn is a field holding various elements and connections between everyday processes.

Another area of cognition interest is the concept of representations that allow individuals to draw on experiences of knowledge. Representations are classes of entities used to understand new subjects (Murphy & Hoffman, 2012). Background knowledge can be deemed a representational category emulating a complete understanding of how information is accepted at present. Two strands of conceptualizing are studied however, which makes the overall idea of concepts hard to decipher. These two strands have separate focal points for obtaining concepts. First strand utilizes formal aspects of categories, and studies artificial category learning, whereas second strand focuses on content concepts and how learning interacts with prior knowledge (Murphy & Hoffman, 2012). Grasping the idea behind concepts leads to two main figurative means of theory concepts with the first strand. The first is a classical view brought about by the notion that concepts could be represented by a set of properties or features that are picked out of a category of features (Murphy & Hoffman, 2012). The second notion is that of using prototypes and exemplar models to offer conceptions based on entire classes or encountered examples (Murphy & Hoffman, 2012). Roughly, notion of prototypes and exemplar models are most used today. A more formal look can be made at the two strands of prototype and exemplar concepts as discussed previously. Numerous means exist to classifying, as models of classification, process models, etc. First to comprehend are models of classification, which are sub-categorized into context and mixture models. Classification of models corresponds to the idea of exemplars, which is with the idea of

context models in dimensions and can provide a mismatch to the example. Context models can correspond with prototype theory and take into account that exemplars will become basis for categorizations and provide a positive or negative fit to data (Murphy & Hoffman, 2012). Mixture models have stemmed from both of these two context models and learning categories means. Models are one set of ideas that have paved a way for understanding concepts and categorizations as fixed-performance models (Murphy & Hoffman, 2012). However, not all models have been created with explanation of classification as their endpoint. Process models are devised to observe performance of classification throughout course of learning (Murphy & Hoffman, 2012). Numerous means exist to devising a process model. Second strand of concept deviates away from artificial learning and explores, as stated earlier, normal learning interaction with prior knowledge (Murphy & Hoffman, 2012). Prior knowledge and interaction with information to form connections have been observed creating an ease of category learning (Murphy & Hoffman, 2012). In turn, prior knowledge allows for memorization of exemplars allowing optimized category learning, but being dependent on the process applied to learning. Situational classification has been observed affecting outcome of conceptualizing or categorizing items provided (Murphy & Hoffman, 2012). Overall, conceptualization is a broad subject with vast quantities of models to provide knowledge about categorized learning.

Language is a key component to tying together all cognitive aspects. Hence, each area observed previously, and here after, is entwined with language (Jackendoff, 2012). Language is a combinatorial system that can express an unlimited number of different

messages on basis of a finite vocabulary, allowing individuals to utter unique convection to inform, inquire, instruct, command, promise, amuse, seduce, terrorize, etc. (Jackendoff, 2012). Language is a medium of cognitive ability to redeem a message of individualistic cause and effect. Language can be divided into a linguistic structure representing phonological, syntactic and semantic structures (Jackendoff, 2012). Phonological is vocal notation of sound sequencing. Syntactic is grammatical structuring of words as nouns, adjectives, and verbs, to name a few. Semantics is implicit and explicit meaning or constitution of spoken or written construct to either a mental or visual representation to instantiate an individual's understanding. From combination of the previous details, language theory has led to integration in cognitive science with language perception proceeding from sound to meaning; language production proceeding from meaning to sound; and generative grammar proceeding algorithmically outward from syntax to both meaning and sound (Jackendoff, 2012). Tying together three broad, unique details creates means of cognitive relation to language's part in bringing the world around an individual to light. With this perception can be made that words are bricks for linguistic structure. From here a words-rules continuum is observed that words, idioms, and meaningful constructions, are pieces of structure stored in long-term memory. They are retrieved from working memory and used in construction of structure (Jackendoff, 2012). Words form sentences that are used to express a meaning for cognitive processing. For this, grammar is perceived as stored knowledge of structures in which words are retrieved promiscuously from long-term memory, leading to a tight relation between “competence” grammar and processing: the “competence”

grammar characterizes pieces of structure and relations among them that are deployed in perception and production (Jackendoff, 2002, 2007, 2012). Language is a unique area of observation that comprises many detailed subjects for cognitive processing.

Cognition varies in forms of brain function that not only supply humans with ability to learn but to feel. Emotions are not random mental events, but responses in systematic and predicable ways and to some degree, are distinguished by their causes making different emotions derivatives from different things (Prinz, 2012). Emotions are informational in terms of their guiding action from different accounts of interaction. Emotions can be broken down into two types: cognitive and non-cognitive. In a broad sense, cognitive events can be understood in terms of the umbrella term, "thoughts" (Prinz, 2012). Thoughts are mental episodes that require use of concepts allowing thoughts to maybe be unbidden or automatized and going beyond mere sensations to present the world as being a certain way through processes of deliberation affected, in many cases at least, by reasoning (Prinz, 2012). Along with this, emotions can be brought about through non-cognitive causes. Elicitors of emotions as non-cognitive can be perceptual states such as visual, smell, sound, and touch (Prinz, 2012). From influencing causes, it stands to learn what causes are created by emotions, however much debate is unsettled in this area. The most basic area is that there are several considerable constituents of emotions: cognitive states, such as appraisals, levels of arousal, emotional valence, perceptions of bodily change, action tendencies, or some combination of these (Prinz, 2012). Possibilities from causes created by emotions makes this area a broad scope of knowledge. At this point, emotions can play effect onto human

behavior or cognitive state. Emotions can, in the least, mean to play a positive or negative role in behavior depending on stimulus or situation (Prinz, 2012). Opposite of this, emotions can influence our cognition influencing what humans think about and how they think (Prinz, 2012). Both areas are broad areas that effect emotions on individual states. From here final aspect of cognition is observed: consciousness.

Consciousness can be a “normal waking state" (Lycan, 2012). Neurophysiologically, insofar means “the ability to react to stimulation in the environment” or “being aware” or “the having of perceptions" (Lycan, 2012). It can also mean “to be conscious it is only necessary to be aware of the external world,” as it is perceiving, by one sense modality or another, with human perceptual systems (Lycan, 2012). Although this is one sense of consciousness, there are many more broad facets to the area. Whether they are philosophical, or psychological, consciousness is with or without awareness, sense, perception, and thought. However, consciousness holds a large multiplicity of topics that are uniquely diverse: empirical questions of accessibility, attention, and reportability; intentions and the control of voluntary action; various temporal anomalies, in which subjects seem to become aware of events before those events have happened (color phi, the cutaneous rabbit, etc.); the Binding Problem(s), e.g., of how the brain synthesizes information from different sense modalities into a unified experience; the development of the self-concept; deficits and neglects; the possession of information without awareness of that information (blindsight, semantic priming, agnosias with “covert knowledge”); issues of unity and identity as in split-brain subjects; and unexpected failures such as change blindness (Lycan, 2012).

Consciousness varies to its subject meaning and is too broad to approach any further, but it is a base of cognitive understanding. With consciousness comes together the previously listed areas and creates a state of human cognition.

Overall, cognition is a state of various ideas to form the human mind. It is composed of numerous theories to describe the processing of signs, sensory inputs, in the world. By combining cognition with information and semiotics examination of information technology adoption and acceptance can take place. Lastly, information is sensory input, technology outlet is the means to communicating information, and adoption is cognitive effect of interacting with sensory input. This leads to basic theories for technology adoption and acceptance.

2.5 From Cognition to Information Technology Adoption, Acceptance, and Use

> It is often assumed that people would readily adopt systems using new technologies to replace traditional ones. After all, we are already moving from the social structure of the X generations who are exposed to the Internet in their youth to the Net or Y generations who do not know life without the Internet (Oblinger, D., & Oblinger, J., 2005). Therefore, it is likely that these X and Y generations would take to technologies like ducks to water. (Sanni, Ngah, Karim, Abdullah, & Waheed, 2013, p. 250; Moore & Benbasat, 1991)

Information technology acceptance is based on eight grounded models. These eight models are the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975), the Technology Acceptance Model (TAM; Davis, 1989), the Motivational Model (MM; Davis, Bagozzi, & Warshaw, 1992), the Theory of Planned Behavior (TPB; Ajzen, 1991), the Combined TAM and TPB (C-TAM-TPB; Taylor & Todd, 1995), the Model of PC Utilization (MPCU; Thompson, Higgins, & Howell, 1991), the Innovation Diffusion Theory (IDT; Moore & Benbasat, 1991; Rogers, 1995), and the Social Cognitive Theory (SCT; Bandura, 1986). The model that combines all eight of these models is Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh, Morris, Davis, G., & Davis, F., (2003) seeking to tie together all previous research on technology acceptance by creating a theoretical model for individuals needing to assess success for new technology introductions along with helping them understand drivers for acceptance (Murch, 2012; Venkatesh, Morris, Davis, G., & Davis, F., 2003). Following paragraphs briefly touch upon the eight grounded theories and models that make up UTAUT to comprehend process of adoption.

Theory of Reasoned Action (TRA), developed by Fishbein and Ajzen (1975), states individuals' intention for certain behavior is influenced by their attitude towards behavior and their subjective norms (Jeyaraj & Sun, 2013). Drawn from social psychology, this model is considered one of the most important theories of human behavior (Martins, Oliveira, & Popovic, 2014). According to researchers, attitude (towards performing behavior) and subjective norms (social pressures to perform behavior) are deemed determinants of behavior in TRA (Martins et al., 2014). TRA is

base for understanding following theories, attitudes, and behaviors towards adoption of new innovations (i.e. technology).

Technology Acceptance Model (TAM), introduced by Davis (1989), was developed to explain process of technology adoption by individuals (Oostrom, van der Linden, Born, & van der Molen, 2013). Adoption and continuance of information technology (IT) innovations by individuals continues to be an important consideration for organizations where adoption generally refers to an individual's decision to use the innovation for the first time and continuance refers to the individual's decision to persist with the innovation well beyond its first use (Jeyaraj & Sun, 2013). Adoption is initial acceptance and continuance is based on post-adoption. TAM is influenced by the Theory of Reasoned Action. It is this understanding of individual acceptance, adoption, and use of information technology that makes it one of the most mature streams of information system research (Thong, Venkatesh, & Xu, 2012; Benbasat & Barki 2007; Venkatesh et al., 2003). TAM states that intention to use technology is mainly influenced by two specific attitudes, perceived usefulness and ease of use; perceived usefulness is the degree a person believes that using a particular system enhances one's job performance; and perceived ease of use is the degree a person believes that using a particular system would be free of effort (Oostrom et al., 2013; Davis, 1989). Recruiter characteristics also relate to adoption of new selection technology when it comes to personnel selection because individual characteristics play an important role in human cognition and behavior (Oostrom et al., 2013). TAM provides a pathway into Theory of Planned Behavior.

Theory of Planned Behavior (TPB) was introduced by Ajzen (1991) as an improvement to TRA by adding a third antecedent of intention, perceived behavioral control (Teo, 2011). TPB states that attitudes, subjective norms, and perceived behavioral control are direct determinants of intentions that influence behavior (Teo, 2011). In TPB, behavioral intention is the most influential predictor of behavior that determines how hard people are willing to try to perform a behavior (Teo, 2011; Ajzen, 1991). Behavioral intention is effected by attitude towards behavior, subjective norm, and perceived behavioral control (Teo, 2011) Attitude towards behavior is one's positive or negative feelings about performing a behavior (e.g., using technology) and subjective norm (e.g. social influence) refers to one's perception of the extent to which people important to the individual think the behavior should be performed (Teo, 2011). Perceived behavioral control is a person's perception of how easy or difficult it would be to perform a behavior which is similar to perceived ease of use in TAM (Teo, 2011; Ajzen, 1991).

Motivational Model (MM) is a body of research in psychology used to explain behavior. MM consists of two types of motivations, extrinsic and intrinsic. Extrinsic motivation is the perception that individuals want to perform an activity (behavior) if it's perceived to be useful in achieving valued outcomes (Venkatesh et al., 2003; Davis et al., 1992). Intrinsic motivation is the perception that individuals want to perform an activity (behavior) for no reason other than the process of performing it (Venkatesh et al., 2003; Davis et al., 1992). Motivation has been tied to attitude and discussed later on.

Combined TAM and TPB is a hybrid form of individual acceptance utilizing both predictors from TAM and TPB. For more information on Combined TAM and TPB refer to previous paragraphs about TAM and TPB.

Model of PC Utilization (MPCU) is a derivative from Triandis' (1977) theory of human behavior, presenting a competing perspective to TRA and TPB (Venkatesh et al., 2003). MPCU first is based on the extent, which an individual believes using a technology enhances one's performance (Thompson, Higgins, & Howell, 1991). MPCU is built on the degree an innovation is perceived difficult for use and is focused on outcomes having long-term consequences (Thompson, Higgins, & Howell, 1991). With these constructs, MPCU is an affect towards use, such as feelings associated with an individual's action, social factors, and facilitating conditions such as factors in the environment (Thompson et al., 1991).

Innovation Diffusion Theory (IDT) deems that individuals make decisions to adopt or reject an innovation based on formed beliefs (Lee, Hsieh, & Hsuan, 2011; Agarwal, 2000). To really understand IDT, breakdown its name is useful. Innovation has been defined as an idea, practice, or object that is perceived new by an individual (Lee et al., 2011; Rogers, 1995). Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system (Lee et al., 2011; Rogers, 1995). These two terms help bring a complete picture of beliefs formed about an innovation. IDT also has five main characteristics, which explain adoption and process of whether or not to adopt. Characteristics are relative advantage, compatibility, complexity, trialability, and observability (Lee et al., 2011).

Relative advantage is the degree to which an innovation is considered better than the idea it replaced which makes it one of the best constructs for predicting adoption of an innovation (Lee et al., 2011). Compatibility is the degree an innovation is regarded as being consistent with potential end-users' existing values, prior experiences, or needs and is similar to those found in TAM (Lee et al., 2011). Another construct similar in TAM is complexity which is the end-users' perceived level of difficulty in understanding innovations and ease of use (Lee et al., 2011). Lastly, trialability refers to the degree in which innovations can be tested on a limited basis and observability is the degree to which results of innovations can be visible by others (Lee et al., 2011). These constructs may also be found in the other six models and theories discussed earlier.

Social Cognitive Theory (SCT) is based on adoption of agent perspective for human development, adaptation, and change (Bandura, 2002). Theory distinguishes among three modes of agency: personal agency exercised individually; proxy agency in which people secure desired outcomes by influencing others to act on their behalf; and collective agency in which people act in concert to shape their future (Bandura, 2002). Capacity to exercise control over nature and quality of one's life is the essence of humanness (Bandura, 2001). This is deemed a human agency. Human agency is cognitively characterized by core features that operate through phenomenal and functional consciousness (Bandura, 2001). Features include temporal extension of agency through intentionality and forethought, self-regulation by self-reactive influence, and self-reflectiveness about one's capabilities, quality of functioning, and the meaning and purpose of one's life pursuits (Bandura, 2001). Personal agency is intended as it

operates within a broad network of sociostructural influences and, in these agentic transactions, individuals are producers as well as products of social systems (Bandura, 2001). Through SCT we begin to understand cognition's role on behaviors that are brought about for adoption. Thus, SCT identifies personal, behavioral, and environmental factors that influence people's behaviors (Ramirez, Kulinna, & Cothran, 2012).

All eight of these models and theories can be tied together and interlinked forming the UTAUT. However, one link that this study touched on in more depth is attitude. Attributes and behavior in terms of adoption research have shown that attitudes can be seen as a middle effect. Behavior is influenced by attitude and formed in a mental state. For further understanding of information technology adoption reviews innovation attributes through perception in terms of perceived usefulness, ease of use, and compatibility (Jeyaraj & Sun, 2013). Along with this review of individual characteristics in terms of expertise, personal innovativeness, and self-efficacy occurred (Jeyaray & Sun, 2013). Adoption also pertains to continued use of information technology through facilitating conditions and social influence, or contextual factors (Jeyaraj & Sun, 2013). These three ideas affect attitude, which is the second observed state. From attitudes, reviews touches upon brief definition of behavior and, lastly, adoption stages.

Prior to discussion of attitudes, innovation attributes and individual characteristics are reviewed as basics for adoption comprehension. Rogers (2003) proposed, through Diffusion of Innovations, adoption revolves around several innovation attributes, of which relative advantage, complexity, and compatibility are salient (Jeyaraj

& Sun, 2013). First, perception is reviewed through the three attributes. In cognition, perception was concluded as cognitive processing implying sensory (audio) information processing is contiguous with symbolic (visual) information processing (Anthony, 2005). As stated before, perception is what humans perceive which shapes thinking and guides actions (O'Callaghan, 2012). Relative advantage, in adoption, refers to perceived benefits of adopting an innovation, relative to other alternatives, and is similar to the notion of perceived usefulness (Jeyaraj & Sun, 2013). Complexity is the difficulty in adopting a technology innovation, which is an inverse of perceived ease of use in technology adoption (Jeyaraj & Sun, 2013). Lastly, compatibility fits between technology and adopter's work, needs, and preferences, which is related to notions of work compatibility in technology adoption (Jeyaraj & Sun, 2013). These three innovation attributes are expected to exert a positive influence on individual's intention to adopt an innovation in either pre or post stage of adoption (Jeyaraj & Sun, 2013). During early stage adoption, non-adopters (i.e., innovators and early adopters) are most likely to consider their innovation attributes in decisions to adopt an innovation (Jeyaraj & Sun, 2013). However, during the later stage of adoption, non-adopters (i.e., early majority, late majority, and laggards) may place importance on innovation attributes whereas adopters are likely to evaluate an innovation in deciding whether to continue using it (Jeyaraj & Sun, 2013). Contextual factors have been theorized to strongly influence post-adoption. Impact of contextual factors on individuals' behavioral intention to use an innovation or usage behavior has been extensively tested and validated across a wide range of contexts both in the UTAUT and other studies (Jeyaraj & Sun, 2013).

Venkatesh et al. (2003) and UTAUT extend on TAM in terms of including two contextual factors, i.e., social influence and facilitating conditions (Jeyaraj & Sun, 2013). As already discussed, facilitating conditions are the degree to which an individual believes an infrastructure exists to support use of the innovation, and social influence is the degree to which an individual perceives that others, important to them, believe that they should use the innovation (Jeyaraj & Sun, 2013). Later on discussion reviews the stages of adoption and where individuals fall in terms of innovators, early-adopters, etc. These basics are starting points for adoption, which lead into attitude.

Attitude is a broad subject with many theories attributed to its nature. Attitude can be, in a general sense, defined as a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Chaiken & Eagly, 1993). Through this general definition psychological tendency refers to a state that is internal to the person and evaluating refers to all classes of evaluative responding (overt, covert, cognitive, affective or behavioral) (Chaiken & Eagly, 1993). Attitude represents a mental state. Evaluative responding forms a psychological tendency when it forms an attitude and thus, makes attitude a hypothetical construct (Chaiken & Eagly, 1993).

Previously, attitudes are thought to be in the mind. This makes attitudes not directly observable, but able to be inferred from observable responses (Chaiken & Eagly, 1993). Observable responses are explicit actions from stimulus inputs. When certain types of responses are elicited by certain classes of stimuli, it is inferred that a form of mental state has been engaged (Chaiken & Eagly, 1993). Attitude is a tendency in that it is an internal state that lasts for at least a short time which can be learned, unlearned, or

acquired in a biological state (Chaiken & Eagly, 1993). Attitudes can be evaluative. Attitude as an evaluative tendency means that it is an evaluative state that intervenes between certain classes of stimuli and certain classes of responses accounting for covariation (Chaiken & Eagly, 1993). In evaluating responses observations look toward positive or negative responses. Responses are evaluative where evaluation is imputation of some degree of goodness or badness to an entity (Chaiken & Eagly, 1993). These evaluative responses and tendencies underlying them differ in valence, or direction (Chaiken & Eagly, 1993). When looking at valence or direction examination is set to look for positive or negative response. Hypothetical state that represents evaluative responding is described on a bipolar continuum or dimension ranging from extremely positive to extremely negative and includes a reference point of neutrality (Chaiken & Eagly, 1993).

With measuring the positive and negative response, evaluation also observes the physical state. Physical state of evaluation is always made with respect to some entity that is the object of evaluation (Chaiken & Eagly, 1993). Entities are known as attitude objects in that they yield the stimuli that elicit evaluative responses that are regarded to follow from an attitude (Chaiken & Eagly, 1993). Attitude objects promote response. Attitude objects can be abstract or concrete with abstract objects revolving around common studies that apply to social attitudes of social policies, ideologies, or social groups (Chaiken & Eagly, 1993). Attitude objects are viewed from both the abstract and concrete stance. Attitude objects are encoded from a variety of stimuli to form a class that is observed (Chaiken & Eagly, 1993). It is when observations of an individual show

that a class of stimuli (those denoting a given attitude object) and a class of this individual's responses (those expressing a given degree of evaluation) covary, social scientists infer that this individual holds an attitude towards this entity which makes attitude a latent variable (Chaiken & Eagly, 1993).

Attitude, cognition, and behavior all tie together, yet are each individual components of importance. Attitude can be summarized, in a general sense, as follows: an outcome of cognitive activity, such as categorization process, that as a result of having evaluated an entity with some degree of favor or disfavor, an individual may assign evaluative meaning to the entity and then possess an attitude, which is an internal state that endures for at least a short period of time and presumably energizes and directs behavior (Chaiken & Eagly, 1993). Described by Allport, an attitude is a mental and neural state of readiness (Chaiken & Eagly, 1993). It is common to believe that the mental attitude effects behavior. Laypeople often infer that individuals' attitudes account for patterning of their evaluative behavior (Chaiken & Eagly, 1993). It has been seen though, that some of these attitudes do not have an attitude object and can be a personal or mental attitude (Chaiken & Eagly, 1993). People also may commonly infer the attitudes that underlie their own and others' behaviors, plus they may often think about themselves and others in terms of attitudes that their public statements and overt behavior convey (Chaiken & Eagly, 1993). This form of attitude is brought about through inquiry of others' attitudes. Following this, more focus is placed on an attitude object framework of the individual's own internal attitude.

Previously stated, responses that express evaluation and reveal people's attitudes should be divided into cognition, affect, and behavior (Chaiken & Eagly, 1993). Cognitive responses contain thoughts people have about the attitude object, affective responses contain feelings or emotions that people have in relation to the attitude object, and behavioral responses contain people's actions with respect to the attitude object (Chaiken & Eagly, 1993).

First, cognitive evaluative responses are thoughts or ideas about the attitude object in which the thoughts are conceptualized as beliefs, associations, or linkages that individuals establish between the attitude object and various attributes (Chaiken & Eagly, 1993). Cognitive evaluative responses include covert and overt responses, and attributes associated with the attitude object express positive or negative evaluation that can be located on an evaluative continuum (Chaiken & Eagly, 1993). Second, affective evaluative responses consist of feelings, moods, emotions, and sympathetic nervous system activity that people experience in relation to attitude objects and therefore can be located on an evaluative dimension of meaning (Chaiken & Eagly, 1993). Third, behavioral evaluative responses consist of overt actions people exhibit in relation to the attitude object (Chaiken & Eagly, 1993). In general, a stimuli denotes the attitude object, which is an inferred state, and expresses the three observable responses (cognitive, affective, and behavioral).

Opposite of the idea of attitude as an inferring state, is that attitude can be a product of cognitive, affective, and behavioral processes (Chaiken & Eagly, 1993). Attitudes are derivatives of the three processes in either an individual or combined state.

First, a cognitive learning process is assumed to occur when people gain information about the attitude object, through direct or indirect experience with it and thereby forming beliefs (Chaiken & Eagly, 1993). Second, an attitude formed on the basis of affective experiences can be viewed as a product of pairing an attitude object with a stimulus that elicits an effective response or through the idea that affective responding underlies attitude (Chaiken & Eagly, 1993). Lastly, as stated earlier about individuals' inferences, attitudes are derived from past behavior and behavioral responses (Chaiken & Eagly, 1993). Attitudes, overall, are implicit overt and covert responses. However, attitudes do not require all three aspects either at the point of attitude formation or at the point of attitudinal responding (Chaiken & Eagly, 1993).

By utilizing cognitive, affective, and behavioral expressions different perspectives arise. One perspective to analyze attitudes can be to regard them as one type of schema, which is a broader classification of cognitive structures (Chaiken & Eagly, 1993). Cognitive structures allow for organization. Schemas are structures of organized, prior knowledge, abstracted from experience with specific circumstances (Chaiken & Eagly, 1993). Schema construct resembles the cognitive aspect of attitudes in that experience with attitude objects is assumed to lead people to associate them with attributes or, more generally, to think about attitude objects (thoughts stored and regarded as cognitive structures that organize prior knowledge) (Chaiken & Eagly, 1993). Schemas can be useful in regards to attitudes. They allow individuals to represent and organize information encountered, echoing an important theme of attitude theory as analysis of the functions or needs that attitudes serve for individuals (Chaiken & Eagly,

1993). Danial Katz's taxonomy relevant to attitudes best shows this. Katz composed four functions relevant to attitudes with presumption that general needs or motivations energize and direct them (Chaiken & Eagly, 1993). Katz's four main functions are as follows: knowledge function asserts that attitudes serve to organize and simplify people's experience; utilitarian function presumes that attitudes enable people to maximize rewards in their environment and to minimize punishments; ego-defensive function asserts that attitudes also enable people to protect themselves from unpleasant realities; and value-expressive function states that attitudes allow people to express their personal values and self-concept (Chaiken & Eagly, 1993). These four functions all tie back into cognition through motivation, which has become a contemporary research area for attitudes.

Through understanding the basics of attitudes when concerned with cognitive, affective and behavioral aspects, examining adoption technology and its utilization of these fields can proceed. Studies have investigated the impact of individuals' attitudes towards technology (Hartwick & Barki 1994). Attitude is broadly used as a learned predisposition to respond in a consistently positive or negative manner with respect to a given sensory input (Fishbein & Ajzen, 1975). Observation reviewed individuals' attitudes, directly and indirectly, towards information sources used for agricultural data. An individual's positive or negative evaluation of performing a behavior is deemed an attitude toward a behavior (Jin Kim, Song, & Uk Chun, 2009). Formation of an attitude towards a behavior involves an individual's judgment about performing a behavior as either good or bad and a general evaluation of an individual's inclination or

disinclination to perform that behavior (Jin Kim et al., 2009; Ajzen & Fishbein, 1980) Consideration can be made that attitude guides an individual's behavior by filtering information and shaping their perception of the world (Jin Kim et al., 2009; Fazio, 1986). Attitude research has also shown that some attitudes are weakly predictive of corresponding behaviors, whereas others are strongly predictive of behaviors (Jin Kim et al., 2009; Krosnick & Petty, 1995). So how does this affect adoption of a new innovation (i.e. information technology source)? Attitude and behavior are connected. Through analyzing attitude strength, in terms of certainty, accessibility, and extremity attributes, attitude can be examined as an indication of behavior. Previous research has shown that attitude strength toward using a system has a significant effect on both cognitive processes of acceptance and attitude–behavior consistency (Jin Kim et al., 2009). Formation of a strong positive or negative attitude can be affected by the individual and contextual variables presented through the eight models and theories of UTAUT (Jin Kim et al., 2009; Petty, Wegener, & Fabrigar, 1997). At this point, description of behavior aims to help in comprehending the rounded picture of adoption, acceptance, and use of new technology plus categories for identifying adopters.

Behavior is the base of psychology. It is foundation of all previous areas discussed. Behavior is a vast attribute. Review will briefly touch on behavior. Behavior, in its most general sense, is describable as the overt or covert attempt of an individual to bring about some state of affairs for change or maintenance (Bergner, 2011). Psychology can be thought of as the science of behavior and that all the different aspects (cognition,

physiology, etc.) tie into this phenomenon (Bergner, 2011). In this setting, adoption is a behavior and the overall aspect worked towards.

In finalizing this section, discussion touches on adopters. Recalling Rogers's Diffusion of Innovations, observation looks at the categorizing or grouping of adopters (i.e. innovators, early adopters, early majority, late majority and laggards), or individuals who adopt (i.e. communication and technology adoption). Through this research conclusion formed that an early adopter is generally younger, has more financial lucidity, a higher social status, an advanced education, searches more for information, has a closer contact to scientific sources and interaction with innovators, is more social, and shows a higher degree of opinion leadership than a late adopter (Sopha, Klockner, & Hertwich, 2011). Rogers' adopters and non-adopters were compared with respect to age, income, education, information search and source, and communication patterns (Sopha et al., 2011). Fact that decisions are not only influenced by personal needs, but also by social requirements has shown that early adopters usually lean more towards their personal needs and have higher aspiration levels than late adopters (Sopha et al., 2011). Rogers proposed that adopters might be categorized based on Bell curve categorizing (i.e. innovators, early adopters, early majority, late majority and laggards), yet rate of adoption follows the sigmoid (s-shaped) curve path (Rubas, 2004). Sigmoid curve can be explained through epidemic, Bayesian learning, and game theory. These theories provide evidence for diffusion process. In epidemic approach, Mansfield (1961), states that as information spreads, firms or individuals adopt, thus adoption spreads (diffuses) through information. However it lacks theoretical basis and exogenously determines an adoption

ceiling (Rubas, 2004). Following epidemic, Stoneman (1981) developed a model based on Bayesian theory of learning focusing on intra-firm diffusion instead of inter-firm diffusion in which the s-shape arises because agents change their intensity of adoption as they learn about the new technology and modify their expectations allowing the adoption ceiling to be determined endogenously (Rubas, 2004).

Lastly, Reinganum studied game theory, which uses strategic behavior to explain the s-shaped adoption curve. Reinganum looked at a two-person, non-zero sum game where players are identical, and information is perfect. She found that two Nash equilibria exist and that in each equilibrium, one player adopts first, explaining that when firms or individuals are not identical and there is a net gain for the first adopter, there is always an asymmetric Nash equilibrium (as long as the value of adoption declines with the number of adopters, adopters adopt sequentially) (Rubas, 2004). All three of these theories provide a basic understanding of the sigmoid curve in correlation to diffusion of technology. Overall, adopters are the basis of any study analyzing new concepts, technology, or innovations in general. They are subjects that provide identification to behavior that may occur. Overall, in analyzing all of the means to adoption of new technology, further research might be needed for better progressive grasping of subjects.

2.6 From Adoption to Agriculture Ontologies and the World Wide Web

> The fundamental units of agricultural information are the smallest subdivisions of information that are relevant to a particular part of a process of agricultural production and operation. The determination of these minimal units of agricultural information is closely related to the determination of the operational phases of a given agricultural production process, with the combination providing a link between the narrow and broad ontology. (Bergmann, Fang-qu, Jian, Yong, & Zhi-qiang, 2012, p. 839-848)

It has been previously stated that the agricultural domain or industry is a significant area in need of multi-source knowledge management so as to aid farmers, extension workers and researchers in their informational data need (Kawtrakul, 2012). With the amount and value of available information simultaneously increasing, the challenge turns to distributing that information in a more personal, specific manner (Gillespie, 2009; Boehlje & King, 1998). Sources of data are scattered at several locations in heterogeneous formats that try to offer structured information to large unstructured information volumes (Kawtrakul, 2012). Information technology has continually changed the way data is disseminated from source to user, and from this it has allowed data to become more audience-specific and decision-focused, answering questions such as who are customers, what do they want, and when do they want it. (Gillespie, 2009; Boehlje & King, 1998). Through this, Web sharing and retrieval of

learning resources has been addressed through several initiatives to develop learning technology specifications and make them evolve into a dynamic process, overall leading to the availability of tools that make the sharing of learning resources in repositories (which facilitate search through standardized metadata) effective (Garcia-Barriocanal, Sanchez-Alonso, & Sicilia, 2011; Friesen, 2005; Abian et al., 2008).

Economist, Amartya Sen, best summarized central community building in one word, SwIkriti (Pappu, Prabhakar, & Sarkar, 2010). SwIkriti basically means that everyone, irrespective of their capacity, has a place, function, and role, which describes the economic, social, and cultural value of openness, tolerance, and inclusion (Pappu et al., 2010). Community building is part of any establishing framework. How does this effect agriculture? To start, a community is very different from an audience (Shirky, 2003). How are they different though? Audiences can be built, but communities create themselves and grow (Pappu et al., 2010). To develop a community there is a need for a constitution that includes a way to govern, facilities to create languages of communication and interaction, and methods to recognize and reward contributions by members (Pappu et al., 2010). Agriculture is a community. However, when a community becomes too large and too diversified, it loses its focus as can be seen in agriculture (Pappu et al., 2010). From this stance, it should be realized that a large-scale content creation effort for use by a diverse community requires its own language of communication (Pappu et al., 2010). Following is an example of information transferring through a system:

> [A] paper or article written by a scientist wouldn't be directly relevant to a farmer….[H]owever, it might be useful to a person working in the agricultural research station or an extension worker who needs to provide essential guidance or information to that farmer. Similarly, a user such as an extension worker might want to summarize many articles or papers written by experts, connect such content together, and synthesize it for common, general usage. (Pappu et al., 2010, p. 4)

Information is probably one of the most valuable resources in the agriculture industry, and producers are insatiable consumers of it (Gillespie, 2009; Maddox, 2001; Boehlje & King, 1998). Agricultural information can involve name, price, origin, market conditions, and other various factors of agricultural products that can require dynamic optimization of integrated multi-objective purposes, yet agricultural information for decision-making is often incomplete, and many factors are difficult to quantify (Yong & Yuan, 2012). Humanization of this knowledge is not possible however without a common, shared set of terms of reference (Pappu et al., 2010). Development of agricultural data has put forward a wealth of information from various production and management areas, but with change in information technology and mass multiplication of agricultural information, and due to its complicated, distributed, heterogeneous nature, it stands to show how relatively difficult it is to combine production and management information (Yong & Yuan, 2012).

> In today's agricultural industry, survival often depends on having an edge on information related to the market, efficient allocation of available resources, and use of new or innovative farming practices…The value of information as a commodity in today's information age cannot be overemphasized since it has contributed immensely to the stagnation or the progressiveness of many farming operations. (Gillespie, 2009, p. 27; Riesenberg & Gor, 1989, p. 7)

Over the years, several government and private organizations have been developing various computer-based agricultural information systems and agriculture search engines that combine AGROVOC and Google AJAX API, agri-information dissemination systems, and various integrated agriculture information frameworks aimed at providing information related to agriculture (Bansal & Malik, 2011). As stock in knowledge grows, opportunities for individuals to produce and invest in knowledge causes a raise in productivity (Huffman, 2001; Becker & Murphy, 1993; Jones, 1998). With this increasing value of data, it is also noted that there is a rapid growth in number and type of available information sources (Gillespie, 2009; Diekmann & Batte, 2009). One reason why attempts to build a socially significant system have failed is because of the assumption that anyone in the agriculture chain can produce something for direct consumption by the final, target end user (Pappu et al., 2010). Semantics of collaboration means that there must be production for the nearest neighbor and if this is done, then one can end up with a growing, participatory community (Pappu et al., 2010). Solving this integration of sources to provide convenient and accurate services of agricultural

information, retrieval, and classification has become a trend in agricultural data development (Yong & Yuan, 2012). It is the lack of consistent terms of references for the agriculture domain that has perhaps led to the Internet's dearth of agricultural content (Pappu et al., 2010). Precise and exact terms of reference are a fundamental requirement for goal-oriented communication and interaction and without such terms, it is extremely difficult for any individual in the community to take something from an expert, enhance it, add value to it, and pass it to someone down the chain (Pappu et al., 2010). However, in forming, identifying, defining, and conceptualizing to make a whole construction could be difficult.

To start the process, observation looked into machine or web-centered ontologies. Ontologies in their most simple form are a basic platform for developing knowledge services (Yuan-yuan, Ru-jing, Yi-min, & Xue, 2012). A domain ontology is a means of seeking to reduce or eliminate conceptual and terminological confusion among individuals of a community who need to share various kinds of digital information (Gangemi, Navigli, & Velardi, 2003). Ontologies do this by identifying and properly defining a set of relevant concepts that characterize a given application domain, thus use of an ontology is to specify a shared understanding of a domain (Gangemi et al., 2003). Through this domain understanding, the formation of community begins. An ontology then contains a set of generic concepts with definitions and interrelationships (Gangemi et al., 2003). It is this construction of unifying conceptual framework that begins to foster communication and cooperation (Gangemi et al., 2003). Along with this, it may also provide such benefits as reusability, reliability, and specification (Gangemi et

al., 2003). From a technical standpoint ontologies should include metadata such as concepts, relations, axioms, instances, or terms that lexicalize concepts and from them can be seen as a vocabulary containing a set of formal descriptions (composed of axioms) that approximate term meanings and enable consistent interpretation of terms and their relationships (Gangemi et al., 2003). Construction of an ontology constitutes analyzation of the domain by examining vocabulary that describes entities in population, developing formal descriptions of terms (formalized into concepts, relationships, or instances of concepts) in vocabulary, and characterizing conceptual relations that hold among or within terms (Gangemi et al., 2003). A domain ontology is composed of three levels of generality. These domain independent ontologies include meta-properties and topmost categories of entities and relationships (Gangemi et al., 2003). By identifying these few basic principles individuals can create a foundational ontology and support its generality ensuring reusability across different domains (Gangemi et al., 2003; Gangemi et al., 2002). Second, identification and description of key domain conceptualizations according to the organizational structure is done from the established top ontology (Gangemi et al., 2003). As a result of this the core ontology is created and usually includes a few hundred application-domain concepts. It has been shown that many projects eventually succeed in defining a core domain ontology, but that populating the third-level specific domain ontology with specific concepts is often difficult and when overcome it is done at the price of inconsistencies and limitations (Gangemi et al., 2003; Miller, 1990; Lenat, 1995; Yokoi, 1995).

Overall, web-based ontologies serve as metadata schemas that provide a controlled vocabulary of concepts, each containing explicitly defined and machine-processable semantics (Maedche & Staab, 2001). With information resource integration, ontologies provide an organization method based on knowledge or concepts and profoundly reveal relationships among concepts conducive to further knowledge discovery (Yuan-yuan et al., 2012; Qian and Zhen 2006). In the field of digital agriculture, the real power of ontologies lies in the ability to create relationships among classes and instances, and to assign properties to those relationships that let individuals make inferences about them (Yuan-yuan et al., 2012; Thomas 2009). However, before the adoption of the World Wide Web (WWW), researchers such as Ted Nelson (1965) and Roy Stringer (1992) discussed environments where design of information could be based on the notion of reusable objects (Manouselis et al., 2010). The idea of creating educational components from existing components rather than building those components from scratch is as old as, at least, the conceptual design of the Xanadu hypertext system where each document consists of any number of parts each of which may be of any data type and can be referenced from any other document (Manouselis et al., 2010; Nelson, 1965).

Wayne Hodgins (1994) coined the concept of learning objects through observing LEGO® children toys, in that different small LEGO® components are assembled together forming new, larger structures (Manouselis et al., 2010; Hodgins, 2002). The main idea behind this concept was that individuals can build small instructional components which can be reused and customized in different contexts allowing

individuals to build material by assembling and reusing available small instructional components (Manouselis et al., 2010; Wiley, 2000). An example of a type of learning object would be a website, and an ontology serves to link to it through metadata. One of the most popular definitions of a learning object has been given by the IEEE Learning Technology Standards Committee as any entity, digital or non-digital, that may be used for learning, education, or training, but the definition has been restricted to a digital resource reused to support learning (Manouselis et al., 2010; IEEE LOM, 2002; Wiley, 2002). It has been noted that learning objects should not be confused with information objects, which are objects that have no learning aim (Manouselis et al., 2010; Metros & Bennet, 2002). Along with this, it has been discussed that, opposite of no learning aim, learning objects should include some learning objectives, outcomes, assessments, and other instructional components, along with the object itself (Manouselis et al., 2010). Metadata is descriptive information. It has been simply defined as "data about data" or "information about information" that is structured to identify, describe, explain, locate, or otherwise make it easier to retrieve, use, or manage any resources (Manouselis et al., 2010; Miller, 1996; Steinacker, Ghavam, & Steinmetz, 2001; Taylor, 2003; NISO, 2004; Sen, 2004). Metadata enables discovery and reuse of objects described allowing individuals with the information needed to decide whether an object is appropriate for (re)use in a particular task or context (Manouselis et al., 2010). Metadata is made up of data items that are associated with the resource called metadata elements, and through elemental sets metadata schemas are designed to describe a particular type of resource (Manouselis et al., 2010; NISO, 2004). Through these metadata schemas, ontologies

become influential learning/knowledge service connecting resources to individuals through semantics. However, in order to provide these learning and/or knowledge services effectively, individuals should be presented with only the necessary information that is closely related to their need and interest (Kawtrakul, 2012). Overall, ontologies provide a usable way of formalizing human knowledge into a machine-processable form (Yuan-yuan et al., 2012). New development has also been based around achieving semantic retrieval by ontology and through this ontology construction makes it a central research topic for the semantic web (Yuan-yuan et al., 2012). The agricultural industry is a complex, knowledge system containing vast numbers of concepts and relationships that could be easy to reuse from a domain knowledge stand point.

These systems are abstracted from the complex agricultural knowledge system and it is through ontology technology that one can achieve integration of a variety of information in an agricultural collection (Li Yuan & Yong, 2012). However, ontologies based on an agricultural knowledge management framework create more to take into account, such as knowledge acquisition, knowledge representation, knowledge organization, knowledge mining, and management tools (Ping, Qi-yun, Ye-lu, & Ze, 2012). From here focus is on compartmentalizing the agriculture industry and how this action applies where semantic agricultural data is acquired and the tool usage to provide one representation of semantic agricultural information.

2.7 From the Web to Compartmentalization of Agriculture

> Agricultural literacy can be defined as possessing knowledge and understanding of our food and fiber system. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture. Basic agricultural information includes: the production of plant and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing of agricultural products, the processing of agricultural products, public agricultural policies, the global significance of agriculture, and distribution of agricultural products. (Igo, 1998, p. 11-12; Frick, Kahler, & Miller, 1991, p. 54)

Agriculture is a system. It is an ecosystem of production. It is based around the economics of production of particular commodities (Rice, 1992). It focuses on the inputs of labor and material that are manipulated and managed to maximize quantity and quality output given from a particular resource base (Rice, 1992). At the agriculture system level, organization can range from the organism to field and farm, landscape and region, up to continental and global levels (Andersen et al., 2011). There are several factors that affect its production and these levels. Factors are included in the system and can be political, economic, commercial, social, and ecological limitations; changes in demands; changes in regulation; and technological progress (Bonny, 1998). Responses

are originally at the organism and field levels, which are mainly determined by biophysical relationships (Andersen et al., 2011). However, responses at the farm, regional, and higher levels are affected by socio-economic, political, cultural, and factors stated previously (Andersen et al., 2011). Thus, system is a vast defining word. But what is a system? The generic notion of a system is an organizing principle or conceptual framework to approaching the world and for guiding concrete actions in it and to it (Bawden, 2007). An approach to a system is that it is based on three simple ideas: a system is a whole entity that is separated by its own boundaries from the environments in which it is embedded and to which it is essentially structurally coupled; a system is composed of interacting component parts that are also systems, and thus subsystems embedded in a system; and that all systemic entities have properties that are unique to themselves and emerge through interactions of their component subsystems (Bawden, 2007). In the most general and shortest sense, overall subsystems within systems within supra-systems are organized hierarchically (Bawden, 2007). The word, system, has been discussed in agricultural literature and used by individuals in response to complex interactions within and between physical/biological, management, and social components of the industry (Robb & Weiss, 1985). As it is applied it stretches over an industry, a society, food (though a separate system is style encompassed in agriculture), and numerous other fields of studies, concepts, and research. Production agricultural systems involve many outlets that many commercial agricultural systems in existence today are integrated into (Hoshi & Kozai, 1989). Many advances have led to great altering of agriculture. These advances include: selective breeding and directed

molecular techniques addressing biological shortcomings to overcome environmental limitations; improvements in mechanization to reduce labor requirements and increase productivity along with worker safety; conservation programs to reduce negative impacts on soil and water and improve environmental sustainability (Bennet et al., 2008). A natural division was approached for integrated systems in utilizing agricultural information for representation. Agriculture naturally compartmentalizes itself with the arrangement of individual systems. Frick indirectly talks about compartmentalization by identifying eleven broad agriculture subject areas encompassed in agricultural literacy (Igo, 1998). Subject areas are stated as follows:

> 1) Agriculture's important relationship with the environment, 2) Processing of agricultural products, 3) Public agricultural policies, 4) Agriculture's important relationship with natural resources, 5) Production of animal products, 6) Societal significance of agriculture, 7) Production of plant products, 8) Economic impact of agriculture, 9) Marketing of agricultural products, 10) Distribution of agricultural products, and 11) global significance of agriculture. (Igo, 1998, p. 11-12; Frick et al., 1991, p. 54)

With these areas it can be deemed that the agriculture sector, and food sector (agri-food, combined), is one of the most important sectors of economy encompassing agriculture, the food industry, retail, and all members of society as consumers (Lehmann, Reiche, & Schiefer, 2012). Agriculture is seen as a sector that encompasses

food. Yet, recent reports have indicated that less than 2% of the population (in United States) make a living out of farming, and less than 17% live in rural areas showing that as the percentage of the population directly connected to agriculture continues to decline, a need for the agriculture industry to inform individuals about agriculturally-related issues increases (Hundley, 2009; National Institute of Food and Agriculture, n.d.). Also, there are complexity challenges in agriculture. The agricultural sector faces significant challenges to increase production so as to provide food security for a population projected to rise to 9 billion by mid-century and at the same time protect the environment and function of ecosystems (Rosenzweig et al., 2013). Challenge is the need to adapt (Rosenzweig et al., 2013). Agriculture sector focused on is animal production. Recent advances in animal production practices and genetics have somewhat ensured that in terms of quantity, farmers can more than satisfy demand for most animal products, but since this threat is being removed, politicians, public, and producers are demanding improvements in welfare of livestock and stockman, along with improved product quality (Goedseels et al., 1991). Along with new demands, a variety of novel food technologies and trends have been introduced into food production processes including genetic modification technology, nanotechnology, and food irradiation technology (Aizaki, Sawada, & Sato, 2011; Henson, 1995; Siegrist, 2008; van Putten et al., 2006). Consumers tend to strongly oppose foods produced by these methods, which causes complication to introduction of such techniques, so as to communicate the risks and benefits involved in their use (Aizaki et al., 2011; Frewer, Scholderer, & Lambert, 2003; Grunert, Bredahl, & Scholderer, 2003; Henson, 1995; Siegrist, 2008). Opposite of

these trends, organic and natural production has arisen (Campbell & Rosin, 2011). Research data has shown that consumers purchase organic food due to belief that it is more nutritious and safe, better for the environment and animal welfare, and contributes to worker safety (Steinberg, 2012; Dimitri & Oberholtzer, 2009). Organic retail sales have shown a rise by $17.5 billion and moreover the industry has become one of the fastest growing segments of agriculture over the past decade (Steinberg, 2012; Dimitri & Oberholtzer, 2009; National Agricultural Statistics Service (NASS), USA, 2010). It is these changes in consumer preferences along with scientific and technological developments that are leading towards a significant shift in the structure of agriculture in the production of food with more concern to safety and the role of nutrition in health (Abelson, 1994). Through all of these production trends and challenges it begs the question if individuals understand what agriculture truly is. Information surrounding agriculture, as stated before, is vast and numerous thus causing the form of agriculture to take on different meanings. Focus aims to look at animal production (i.e. beef cattle production) in agriculture as one compartmentalized section or system for observation.

Every year, approximately 58 billion farmed animals (excluding seafood) are raised and harvested around the world for consumption of meat, milk, and eggs (Miller, 2011; Ilea, 2009). Global animal product trade represents one of the fastest consumption, trade growths of major agricultural commodities with an expected 40% growth over the next twenty years (Miller, 2011; FAO 2002; Kennes 2010). Additionally, farmed animal production accounts for livelihoods of over one billion people worldwide; during this increase, changes in economies and scales of production have resulted in shifts of

production in developed and developing countries, and production shifts from extensive to more intensive methods (Miller, 2011; UNESCO 2008). Focus is placed on information in the area of beef cattle production (subsystem) within animal agriculture (system) within agriculture (supra-system). Biological characteristics of cattle production processing are reflected in later discussion, however biological data is seldom stationary and does not have a fixed target value, and mostly displays autocorrelation between successive observations (Mertens, Deuypere, de Baerdemaeker, & de Ketelaere, 2011). Peculiarities observed result from many parameters of cattle production processes that are subjected to systematic variation caused by various fluctuations (Mertens et al., 2011). Thus, to produce and market the type of cattle demanded, cattle producers need access to timely, detailed, and manageable information that is required for live and carcass animal sales, which then can be used to make production and marketing adjustments on future cattle deliveries (Andersen, Mintert, & Schroeder, 2003). When observing beef production, observation is on an agricultural value chain to understand an industry system's unique segments in and of itself. Agricultural value chains can be characterized by: (a) low-value end products (Higgins et al., 2010; Boehlje, 1999); (b) a decline in margin returns; (c) a network of potentially thousands of participants, rather than a linearly integrated set of businesses; (d) strong social drivers, such as lifestyle satisfaction or nature conservation, as well as economic goals (Higgins et al., 2010; Valentine, 2005); and (e) strong genetic, environmental and climatic variability (Higgins et al., 2010). Overall, an example of a value-chain can be seen as a single system of one product.

Theoretical graphic interpretation of data compartmentalizing a livestock species for category representation can be developed for the scheme of industry use. An animal is a composite of set strings of functions and is, in its simplest form, a network of data that can be correlated to a machine. That single one point observed is the manifested animal. An important and majorly developed animal in livestock production is the *Bovine*. Domesticated cattle (*Bovine* - Bos taurus and Bos taurus indicus) have been a significant source of nutrition and livelihood for ~6.6 billion humans around the world (Elsik, Tellam, & Worley, 2009). Dimensionally and metaphorically, the *Bovine* is a processing mechanism containing parallel systems and background information that are later transitional into a product. These animals belong to a clade phylogenetically distant from humans and rodents, the Cetartiodactyl order of eutherian mammals, which first appeared ~60 million years ago (Murphy, Pevzner, & O'Brien, 2004; Elsik et al., 2009). Cattle represent the Ruminantia, which occupy diverse terrestrial environments due to their ability to efficiently convert low-quality forage into energy dense fat, muscle, and milk (Elsik et al., 2009). Identifying this animal into an agile developmental coded entity that can be predictable and transitional into an industry and academia field could lead to further evolutionary findings about cattle-related products such as beef, milk and other goods. Domestication, having begun in the Near East some 8,000 to 10,000 years ago, has exploited these biological processes (Willham, 1986; Elsik et al., 2009). Through domestication, biological systems have been affected by evolutionary changes in the number and organization of genes in cattle lineage including reproduction, immunity, lactation, and digestion (Elsik et al., 2009). Categorically, the domesticated cattle is a

phenomenon of man's intelligent build, making cattle one of the most describable animals of complex functionality to deem suitable for representation. Along with domestication's beginnings, over 800 cattle breeds have been established, representing an important world heritage and a scientific resource to help understand the genetics of complex traits (Elsil et al., 2009). This evolutionary activity is associated with chromosomal breakpoint regions and the propensity for promoting gene birth and rearrangement and it is these changes in the cattle lineage that probably reflect metabolic, physiologic, and immune adaptations due to microbial fermentation in the rumen, the herd environment, and its influence on disease transmission, and the reproductive strategy of cattle (Elsik et al., 2009). Overall, as domestication, farming, and agricultural production become technologically advanced a steadily changing system in a progressive nature begins to take shape. This progressive nature brings forth new data, information, and a variety of means for discovery about that area.

2.8 Agrimantics

> Agriculture production systems have benefited from incorporation of technological advances primarily developed for other industries. The industrial age brought mechanization and synthesized fertilizers to agriculture. The technology age offered genetic engineering and automation. The information age brings the potential for integrating the technological advances into [making data-

driven,] precision agriculture [and markets]. (Zhang, Wang, & Wang, 2002, p. 113-132; Whelan, McBratney, & Boydell, 1997, p. 5)

Domestication has provided zoological differentiation from other animals and plants for commercial production. Since domestication of cattle, humans have tried to select for and promote useful traits in cattle using their knowledge of the composition and organization of *Bovine* genetics to accelerate *Bovine* improvement (Salih, 2008). Technology, in a general sense and as stated above, has crept its way closer to advancement in the field of livestock and crop development (crops being a separate categorical industrial entity that does not flow with conversion in a general sense of the bovine machine unless utilized for feed). Currently the wealth of information available for the bovine has spurred the need for annotation and subsequent interpretation of information (Salih, 2008). It is through delivery of a hypothetical pathway of existence that we can essentially convert said bovine into a coded presence on the computer. One that is progressive to obtaining graphical problems and solutions to industrial needs. To be able to explain the details of coding a semantic-oriented animal of use, one must first understand the three main concepts of the project: technology of identification, the bovine as a whole and the art of simplistic theoretical coding thus agrimantics.

With that said, the origin of the *Bovine* is a vast expansion across history originating in many parts of the world, yet its domestication is a broad and fairly debatable topic that will not be discussed further. It has been the center of wide acceptance that sedentary farmers took the act of domestication of early *Bovine* for

religious beliefs and thus brought about the great expansion of the *Bovine* (Isaac, 1962). The beginnings of the bovine derive from the order Artiodactyla to the suborder Ruminantia (Felius, 1995). Modern cattle then maintain their steady path to the family Bovidae to the tribe Bovini and the group Bovina (Felius, 1995). Moving from Bovina, modern commercial cattle branch away from their bison cousins in the genera Bos (Felius, 1995). Jumping ahead to the species we can derive the Bos primigenius, which will bring us to the domestic form Bos taurus cattle (humpless) (Felius, 1995). A branch from the species is the Bos namadicus, which leads us to Bos indicus (zebu) (Felius, 1995). Bos taurus and Bos indicus cattle are the most common forms of cattle commercial production has utilized. Though this information is not that pertinent to the consumer, it is of understanding for progressing further what the symbols, process and coding will be for deriving the *Bovine*. There are numerous variations of the breeds that have been derived from these two common domestic forms. Following origins and patterns of breeds, one can form the overall basics of the bovine. *Bovine* are ruminants, in that they are cud-chewing animals with a multi-compartment stomach that holds a rumen for microbial fermentation of high fiber feeds. *Bovine* are processed animals for consumption. Products from *Bovine*, such as milk and meat, are vital for human domestic consumption and are the perceived varying forms for the symbol of *Bovine*. Later discussion of the formation of the *Bovine* be attempted to bring about by way of using the area of cattle management as an example.

The medium to convey the message of agricultural material for consumer knowledge will be constructed on the everyday machine that has pervasively invaded

human lives, the computer. Computer is a derivative word from the word ‘compute’ meaning to calculate and can be deemed an electronic machine, devised for performing calculations and controlling operations that are expressed in logical or numerical terms (Khurana, 2011). We will avoid going over the details of the progression of the computer into what is now used today, but will discuss the most simplistic, yet highly technical part of the computer, language. Programming languages are devised into three main categories of machine, assembly and high-level languages. Machine and assembly are deemed low-level languages as they are maintained in varying forms of binary and letters to allow for representation of data. High-level languages are written with the concept of natural language, utilizing words and symbols, that are converted by compilers/interpreters into machine-readable binary (Khurana, 2011). Though there are numerous languages to talk about and traverse to create a more appropriate base for language use, the basic idea that should be acquired is the fact that words and symbols are representations of functions, processes and actions. In bringing about this idea, one can tie agriculture terms to their correlated functions and actions to bring about a better base for understanding the representation of the persuasive symbols used to influence individual recognition and grasp of products.

To retain the idea of a state of the bovine on the computer, one must conceive the simple beginning ideas to coding. Concepts of abstraction into realism are a recent more philosophical stance on the perception of the human mind. The distinction of abstract and concrete material has been a conceived and disputed idea. Though this is a brief synopsis of the philosophies that encompass converting bovine into its coded presence, it

is essential to have this background knowledge for full comprehension. As stated by the Stanford Encyclopedia of Philosophy, one signal event in this development is Gottlob Frege's (1884) insistence that the objectivity and a priority of the truths of mathematics entail that numbers are neither material beings nor ideas in the mind. Frege's perceptions that abstract objects are defined as those that lack certain features possessed by paradigmatic concrete things are coined by David Lewis's (1986) term the Way of Negation (Rosen, 2009). However, from the Way of Negation came about Lewis's Way of Abstraction. As stated in the Stanford Encyclopedia of Philosophy, the Way of Abstraction is that an object is abstract if it is (or might be) the referent of an abstract idea, i.e., an idea formed by abstraction. It has been realized that the Way of Abstraction has been diminished, but the following of modern concepts and ideas have arisen from this philosophy. The main extent of theory in focus has arrived from Crispin Wright (1983) and Bob Hale (1987), which derived from Ferge's statement, that many of the singular terms that refer to abstract entities are formed by means of functional expressions (Rosen, 2009). The most simple approach to explaining Wright and Hale's concepts through Rosen's explanation determines where '*f(a)*' is such an expression, there is typically an equation of the form *f(a) = f(b)* if and only if *a R b*, where *R* is an equivalence relation. It is further stated that an equivalence relation is said relation that is reflexive, symmetric and transitive. As an example of this, the direction from the previous statement of *a* = the direction of *b* if *a* is parallel to *b* (Rosen, 2009). It must be stated that these theories are still under observation, but one can lead into A being bound to turn into *AB = B = BC = C*, which correlates to *M = Bovine* the manifest state of the

bovine's presence on the computer. This in turn condemns *Bovine* to be bound to certain "things," correlated words compose else-if/what-if statements of predictability and further progresses its presence. One can draw conclusions from a more detailed understanding of *M* = *Bovine* and can further progress with the philosophy of abstractions.

The state of being is derived as one static structure at a particular point in time. In the simplest formation of pure mathematical coding, founding theories that consume the basis to functional representation must be understood. For purposes of ease, the graduation into the overall *Bovine* functionality, in the way of human management, will be broken into comprised ideas that base the overall computer reality of the scheme. Therefore, one can then theorize and provide compositional pieces to giving *Bovine* its presence in memory. Thus to begin with a single structured state of *Bovine* we use the representational figure, *M*. *M* is, as a whole, the ambiguous theoretical representation of the bovine, *Bovine* = *M*. In greater detail *M* is the management schematic of the *Bovine* that overall creates said *Bovine*. *Bovine*, complimenting *M* is thus a representational state of a concrete entity. A concrete entity is an individual thing that comes into and out of existence in space and time (Stepanov & McJones, 2009, p. 1). In opposition to a concrete entity, one can observe abstract entities. Abstract entities are individual things that are eternal and unchangeable (Stepanov & McJones, 2009, p. 1). The overall presence of *Bovine* is comprised of abstract entities. For example, *Bovine* is brown. In theory *Bovine* is the concrete entity with brown being the abstract entity. With that being said, the inner connecting piece between an abstract entity to a concrete entity is the

presence of attributes. Alexander Stepanov and Paul McJones in "The Elements of Programming" (2009), describe attributes as persistently changing and yet static when it comes to the abstract entities that make up the attribute. For example, color of *Bovine* is an attribute. Therefore *Bovine* can be subcategorized in accordance with physical attributes containing abstracts, which are coined under concretes.

For technical purposes, attributes will be kept to a minimum with more emphasis on abstract and concrete variations to understanding *Bovine*'s computational presence. In further progression and description one can take *Bovine* away from its single entity presence and in a general sense deem it as a state in time that can be described and augmented by a concrete genus composed of concrete species composed of concrete entities. Due to *M*'s ambiguous nature to *Bovine* the same can be applied to *M* as a state in time composed of abstract genus composed of abstract species composed of abstract entities.

With an understanding of abstract and concrete principles at hand one can lead into the computational relevance of the *Bovine*. In a conceptual theory based on relativity to an industrial need, *M* = *Bovine* holds the key elements to identification. Physical properties are thus translated over to allow for true calculations of traceability. *M* = *Bovine*'s set pertains to critical control points that in turn deem tracing qualities. Through *M* point measuring, predictability becomes a component of tracing. In turn, *Bovine* is the theory of a point predicting a state in time. A point predicting a state in time is the act of defining a data point with a set of paths to other elements of description. These paths are parallel controls to determine and predict *Bovine*'s

progression and presence. *M = Bovine* is the determining identification that can be utilized in the function-argument paradigm of prediction. As a case in point, one can begin with the abstract entity *204*; this number is hypothetical and should in no way be taken as a true estimate of the actual value of a weaning weight. As such, *204* is the equivalent to the species entity *Number*, however *Number* cannot mean *204*. *Number* is a general statement that has many faces to its potential need. From *Number*, one can make the assumption that it is the representational state of the unique genera entity, *Weight* (kgs.). Then incorporate that to the *Weaning Weight* (kgs. at time of weaning), which relates to the time of weaning and thus falls into the state of *Feeding* in the state of *M*. Tracing forward, *204* is the interpretation of a datum, a finite sequence of 1s and 0s that are then represented by the computer. Together the interpretation of *204* and the representation of the datum make a value, which is a defined holding term for an abstract entity. From this point one is to realize that values are the states of objects (Stepanov and McJones, 2009, p. 5). Objects are the representations of concrete entities. Recalling concrete entities are things that are changing, we can represent then with the example *Brahman*. The term *Brahman* is then placed under the species *Breed*, which can be applied under the genera *Bos Indicus*. We can apply more generas to the concrete entity, but for simplistic purposes we will maintain the *Bos Indicus* genera. Genera *Bos Indicus* is thus represented by the functional state of *Bovine* who in turn is the equivalent to *M*. From this manifested link we return, through route of *M*, back to *Weight at Weaning*. Tracing forward, the representation of *Weight at Weaning* is a critical control point of time that leads to predicted paths as stated earlier. *M* can thus be deemed as a set of

circumstantial wording that is correlated to prediction. Which then deems general management as term determining.

It is assumed, under general management for cattle practices that at weaning one will thus apply certain vaccines to protect said hypothetical weaned animal. It has been qualitatively observed that at times and points in the life of an animal the act of performing up keeping roles to protect and enhance must be undertook. With that being said, we can examine, as one example, the input of the vaccine for *Bovine Viral Diarrhea (BVD)*. Through computational observance and prediction, with observation leading into prediction, one can understand further complexity of the problem at hand facing *BVD*. As point predictability traces forward the stance of what should occur, *Weight at Weaning* is then correlated to phrasing of what should have been, determining the *BVD* shot. One will avoid going into details of entities for this example for the sake of a fluid, concise and simple theory, but note that this follows the same trend of abstract and concrete. From then on the set path takes to note, as manifested knowledge, that the shot was either received or not received. This is the point of time, which takes to instance further output. If and only if, one continues with the receiving of the shot, the hypothetical animal is thus tied into the risk reduction of the herd. Of the later, having not received the vaccine, the possible paths can be broken into the animal's possibility of already having *BVD*, the animal is in a *BVD* free region or the risk has increased to susceptibility. There are numerous options to associate with this, but as assumed for simplicity the stated were of main concern. The predicted paths are succumbed to the decision of which route to be taken. Though at this point, it must be understood that the

animal is under the will of the human that chooses the path. From beginning to end it is the human's mapping that created the before and after paths. With this example in line the point of *M* = *Bovine* as a forward projection is thus partially completed. Key values represent data points that are essential to *Bovine*'s elemental presence. *M* can be transferred over to other species as it is a define state of management. Through this is the study of *M*, consequently it is understood that *M* = *Bovine* is, in general, one small part of the puzzle to traceability through prediction points.

In conclusion, *M* = *Bovine* could prove a vital meaning to computational representation. There is the stance that a function cannot exist without input from the human user, as stated previously. *M* = *Bovine* cannot be of use without input from the user and thus is of no importance. Only if the human user identifies it will *M* = *Bovine* be of further value. It should be noted that this paper is missing some parts of the equation. Those parts that are missing are left out for simplistic purposes. *M* = *Bovine* is overall a grasping concept for creating a presence of a livestock species on the computer. This concept is still in mere idea and accusation form. It is by the will of human use that *M* = *Bovine* can exist.

From here, knowledge about the past could help with previous future informational or computational goals such as *M* = *Bovine*. The most advantageous point of history to look at for agricultural information and knowledge begins in the 20th century when American agriculture and rural life underwent tremendous transformation (Dimitri, Effland, & Neilsen, 2005). The results can be either coined as industrial growth or progression of an industry for productivity. Around the early part of the 20th century,

nearly 41% of the workforce was employed in agriculture production (Dimitri et al., 2005). From then on the amount of workforce focused in this area has decreased to a rough estimate of 2% in 2000 (Dimitri et al., 2005). Advent of technological advances and progression towards an efficient state of products grown can be marked as pivotal points in adjusting for a larger change. Following World War II, technological developments occurred at an extraordinarily rapid pace with advances in mechanization and increasing availability of chemical inputs leading to ever-increasing economies of scale that spurred rapid growth in average farm size, in turn declining the number of farms in the rural population (Dimitri et al., 2005). This section is not concerned with the entire history of agriculture growth, but a mere synopsis of the advances that agriculture has faced in a rapid paced market. Along with advances in technology, the industry has faced a dynamic shift to contracting and vertical integration for supply and quality control, globalization and development of special-use, high-value commodities which in turn have changed the structure of agricultural markets, further increasing the specialization and scale for consumer demands to be met when it comes to convenience, ethnic, and health-based pressures (Dimitri et al., 2005). It is the adaptation of the industry that has brought about new and innovative techniques to provide individuals with means to survive. In observation of this though, with growing global markets and shifting progression of food production from one area to another, management of the flow of food is becoming pertinent. Consider that an underlying concern may no longer be the process of producing the food, but obtaining the information about the food. The pinnacle height of production stances has created a new formation of market value that

brings about the growing field of communication products' data. Thus, the Green Revolution that found growth and acceptance with the advent of pesticides and genetically enhanced crops to solve hunger has progressed into the "Digital-Green" Revolution to bring about information for agriculture's advances. However, it has become apparent that animal agriculture is increasingly facing scrutiny relative to its contemporary methods of production and with this the language and discourse used to discuss these methods within and outside the industry is being examined (Croney & Reynells, 2008). Through this understanding all of the pieces are described together.

2.9 Agricultural Discourse

"As a matter of professional ethics and viability, animal industry members should objectively and aggressively evaluate the discourse of farm animal production to ensure that what is conveyed is accurate and intended." (Croney & Reynells, 2008, p. 387)

With technological breakthroughs in management, productivity, and growth, the field of agriculture is becoming a more observable, and yet ubiquitous, informational idea in everyday life. Language has been described as a means to provide a way to structure an individual's experience of one's self and the surrounding world (Croney & Reynells, 2008; Burr, 1995). Many experts in the field of communication have begun to increasingly examine the way discourse similarly relates to beliefs about animal production (Croney & Reynells, 2008). Information in the agri-system has been seen to

follow a historical development of informational main focus areas, which are the result of increasing informational requirements during the last decades (Lehmann et al., 2011). Discourse of information has been deemed the production of knowledge and power via language and it is a way of talking or writing about an area of knowledge or social practice that both reflects and creates structuring of that area (Croney, 2010; Glenn, 2004; Stibbe, 2001). This information has evolved from early logistic requirements over various areas such as traceability, food safety and quality requirements, to recent requirements related to the sustainability of food production, such as the environmental impact or social conditions of food production (Lehmann et al., 2011). Discourse and animal practice are closely intertwined (Croney & Reynells, 2008; Schillo, 2003). Also, these informational main focuses are not mutually exclusive and are partly overlapping (Lehmann et al., 2011). Language offers an effective means of expressing values and norms, such as uses and values, assigned to animals along with providing a mechanism for understanding the role of animals in cultures or societies (Croney, 2010; Glenn, 2004; Stibbe, 2001; Arluke & Sanders, 1996; Schillo, 2003). Individuals in the industry today may need to be mindful of internal and external language choices and what they represent because the belief that animals have value and significance beyond their use is true and held by the general public (Croney & Reynnells, 2008; Dunayer, 2001; Cuomo, 2003). By observing the discourse and means to forming the constructed material used to describe the industry, further development of the agricultural industry can begin to grow while circumventing situations. Overall, "[d]econstructing language and related practices is therefore essential to understanding and changing…relationships with both animals

and members of the public" (Croney, 2010, p. 104; Milstein, 2007; Croney & Reynnells, 2008). In conclusion, combining all of the previously reviewed topics together creates a main basis or starting point for this study.

CHAPTER III

METHODOLOGY

This chapter aims to describe methods and procedures used to develop and conduct this study. Purpose of study was to determine where agricultural data is acquired by individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments and adoption attitude towards utilizing a new media form to acquire agricultural data. Approval of study by the Texas A&M University Institutional Review Board, definition of research design, description of the population and its samples, and data collection and analysis process are included.

3.1 Objectives

1. Identify agricultural knowledge levels.
2. Identify commonly used information sources for agricultural knowledge acquisition.
3. Identify adoption attitude towards using an information source to acquire agricultural information.
4. Compare individuals', in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas

agricultural higher education or extension environments, adoption attitudes towards using an online information source.

3.2 Institutional Review Board

Before any research involving human subjects may begin, both federal regulations and Texas A&M University policy require that these research studies be approved. Texas A&M University Office of University Research Services and the Institutional Review Board (IRB) review studies to protect and ensure the rights and welfare of humans involved in any research. In compliance with these policies, the research study, material, and questionnaire tools were reviewed by the TAMU Institutional Review Board and received approval on August 6, 2013. IRB application number for this study along with all of its material and instruments was IRB2013-0299.

3.3 Research Design

A descriptive, convergent parallel mixed-methods design was employed to identify self-reported, commonly used information sources to gather data about production agriculture.

Descriptive research describes and interprets what is. It is concerned with conditions or relationships that exist; practices that prevail; beliefs, points of

> view, or attributes or relationships that are held; processes that are going on, effects that are being felt; or trends that are developing. The process of descriptive research goes beyond the mere gathering and tabulation of data. It involves an element of analysis and interpretation of the meaning of significance of what is described. (Best, 1970, p. 116)

Quantitative research questions sought answers to identify knowledge levels compared to non-agriculturally minded consumers, commonly used information sources for knowledge acquisition, engagement with agricultural events and technology adoption characteristics. Research questions through qualitative methods focused on individual's use of an online information source.

There are both strengths and weaknesses to using a convergent, parallel design. Convergent designs make for an intuitive and efficient approach to analyzing both quantitative and qualitative data in an independent or combined manner for better understanding a study's overall purpose (Creswell & Clark, 2011). Convergent, parallel designs, however, require in-depth analysis of quantitative and qualitative data. Weaknesses may include differing sample sizes, mergence difficulty of both types of data, and contradictory results (Creswell & Clark, 2011). Understanding these strengths and weaknesses allows for better research development.

Descriptive, convergent parallel mixed-methods was selected for use to also analyze any existing relationships between the two sample groups. Relations were

correlated to obtaining information preferences, communication media use, perceptions of data, and attitude towards interacting with an online information source.

Electronic survey methods have potential to bring great efficiencies to design and management of self-administered questionnaires (Dillman & Smyth, 2007). Electronic methods may also provide opportunities to overcome geographical barriers for conducting surveys (Dillman & Smyth, 2007). With these benefits in mind, this study consisted of online descriptive, quantitative pre and post researcher developed questionnaires. Questionnaires were created and provided through the online software, Qualtrics. Data was collected through Qualtrics. Open-ended questions were included in each groups' posttest and were analyzed as qualitative data to create meta-inferences. Purpose of meta-inferences was to provide further explanation of acquired quantitative answers. However, electronic questionnaires do not come without flaws. Some main concerns of Internet-related questionnaires are error caused by inadequate coverage; compatibility of respondents' computer hardware and software; transmission capability variation based on telecommunications infrastructure; and indirect effects of respondent computer literacy (Dillman & Smyth, 2007; Nocella, Hubbard, & Riccardo, 2010; Schonlau, Fricker, & Elliot, 2002). With increasing technological advances these concerns are being diminished.

3.4 Population and Sampling Procedures

This study used a convenience sampling drawn from a closed population of academic persons. Individuals from an agriculturally-related occupation in Texas were categorized as Group One. Sampling for Group One aimed to reach ~330 participants based on ~2,000-5,000 individuals identified from Texas universities within College of Agriculture and Life Sciences programs, Texas Extension District County Offices, and the Texas A&M and AgriLife Extension system (Bartlett, Kotrlik, & Higgins, 2001). Recruitment of participants was done through initial contact via individuals' email addresses. Contact information for individuals was only viewable by the principal and co-investigator. Partially following Dillman's Total Design Method (TDM), non-responding individuals received a follow-up reminder email containing the questionnaire link a week after the initial email was sent (Bass & Hoddinott, 1966). These subjects, chosen for study convenience, represented current agricultural professionals in Texas. Individuals without a valid e-mail address were excluded from this sample frame. A sample of ~330 participants allowed for marginal room to meet a preferred 240 mark (Bartlett et al., 2001). The criteria used to obtain individuals for this group was exclusionary due to the elimination of potential individuals who may not work in previously stated entities in the spring of 2014 during the time of recruitment.

Group Two consisted of individuals in a higher learning environment at Texas A&M University. Sampling for Group Two aimed to reach ~400 participants based on the number of available students in the Kleberg and College of Agriculture and Life

Sciences buildings (Bartlett et al., 2001). Recruitment of individuals was done through courses that permitted or allocated time for pre-class announcements (i.e. Animal Science 107, 108, etc.). Scripted announcements explaining the nature and location of the study were made to these course rooms. Individual privacy was respected by making announcements to the entire class. If individuals chose to participate they came to a computer station set up in their building where they were provided a consent form to sign before being able to participate. It was these individuals, for study convenience, that represented agricultural consumers in Texas. A sample of ~400 participants allowed marginal room to meet a preferred 260 mark (Bartlett et al., 2001). The criteria used to obtain individuals for this group was exclusionary due to elimination of potential individuals who may not be located at previously stated buildings in the 2014 spring semester during the time of recruitment. Along with this, exclusion that individuals must be 18 years of age or older to participate was enacted.

3.5 Instrumentation

Two researcher-designed pre and post questionnaires were created to address the study's objectives. Instruments were reviewed by a panel of experts to ensure face and content validity. Survey reliability was assessed post hoc.

3.6 Questionnaire Design

Research studies were conducted through online questionnaires via Dillman Tailored Design Method based on less approaches to designing online surveys (Dillman & Smyth, 2007). Dillman's survey suggestions are based on limiting color and visual element use to avoid conflicting with various operating systems and browsers; motivational and informational introduction; and utilizing a universal, interesting question (Dillman & Smyth, 2007). Along with this Schonlau et al. (2002) added to the list of design strategies with authentication to limit survey access; ensuring participants' privacy protection; and providing visual indications of survey progress. However, this study differed from Dillman (2007) and followed Schonlau et al. (2002) by listing only a few questions per screen view rather than listing all questions on a single page for scrolling.

Both pre-questionnaires used skip and display logic provided through Qualtrics Survey Software. Skip logic allowed for respondents to be directed to sets of questions based on their responses to sorter questions. Results collected from these surveys were stored in the cloud. From the cloud, answers were exported to SPSS and Excel to complete data analysis.

By utilizing Qualtrics, questionnaires were able to categorize participants into two main categories: agriculturally-related individuals and non-agriculturally-related individuals. Three subcategories were then established: animal production understanding; crop production understanding; and chemical, pesticide, and fertilizer

understanding. These three subcategories were based on the USDA's categorizing of the agricultural industry.

Survey question one, a Likert-type scale question, divided respondents between the two main categories and three subcategories. If individuals indicated they held a higher or much higher knowledge level than a non-agriculturally minded consumer for a subcategory were further provided questions pertaining to that subcategory. If an individual indicated that they held an about the same, less or much less knowledge level for a subcategory were not provided any further questions concerning that subcategory. Survey Question two, another Likert-type scale question, divided subcategory respondents into sub-subcategories. In following the same rule as question one, individuals that indicated holding a higher or much higher knowledge level for a sub-subcategory were further provided questions pertaining to that sub-subcategory.

Individuals whom indicated a higher or much higher knowledge level in any sub-subcategory were provided a five point Likert-type question to indicate use of information source for agricultural knowledge acquisition. Individuals that did not use any of the provided information sources were provided a short answer section to explain their response.

Once individuals answered questions about their use of information sources for agricultural knowledge acquisition, they were provided a set of questions concerning typical monthly information source visitation, information source preferences, manner of presentation seen in information sources, agricultural event attendance and use of knowledge when purchasing agricultural products. Each topic question utilized a five

point Likert-type scale and one short answer response. Questions were used to determine positive or negative manners of receiving agricultural data and source style preference to obtain agricultural data.

Respondents were asked demographic questions which were used to determine personal and professional characteristics of both sample groups. The demographic section used multiple choice questions to understand gender, race, education, and occupation. Drop-down lists were used to indicate individuals' location and business location.

Lastly, post-questionnaires used a mixture of Likert-type scales, fill in the blank, and multiple choice questions to understand individuals' attitude, perception, and use of the A.R.I.E.L. website. Questions were divided between ease of use of the website and confidence to relay knowledge obtained. Along with the post-survey, browser meta information was collected to determine and understand website compatibility issues that may have arisen for future design principles.

3.7 Validity and Reliability

Pre and post questionnaires' face and content validity were assessed and verified by a panel of experts. The panel consisted of four faculty members from the College of Agricultural and Life Sciences at Texas A&M University. Once questionnaire instruments were reviewed, panel members provided improvement suggestions for the primary and co-investigator. Revisions were made and questionnaires were found valid

for research use. Due to time constraints, reliability was assessed post hoc. Utilizing Cronbach's alpha, internal consistency reliability for each five point Likert-type and seven point Semantic Differential scale, along with subscale, were measured. A benchmark alpha of .7 (Gliem, J., & Gliem, R., 2003; George & Mallery, 2003) and an alpha goal of .8 (Gliem, J., & Gliem, R., 2003; George & Mallery, 2003) were set for each. Reliability scores are reported in data findings.

3.8 Data Collection

It is essential to attempt contacting respondents multiple times in order to achieve a satisfactory response rate for self-administered surveys regardless of method used to deliver them (Dillman & Smyth, 2007). Group One recruitment partially followed Dillman's Tailored Design Method (2007) to acquire survey responses. Items of correspondence (contact-letter email and reminder-letter email with questionnaire and website link) were distributed electronically through Texas A&M University email services. An initial contact-letter email was distributed to Group One individuals listed on the Texas AgriLife and A&M Directory website, on February 7, 2014, or February 8, 2014. Individuals were sent a reminder-letter email on February 12, 2014, or February 15, 2014, which included a link to the online pre-questionnaire. Individuals who did not take the pre or post questionnaire and wished to do so were sent a final email, on February 17, 2014, which contained questionnaire and website links. Individuals in Group Two were contacted via class announcements and asked to participate on

February 9, 2014 through February 23, 2014 at the Kleberg and College of Agriculture and Life Sciences buildings. Questionnaires for Group One were closed and the website was taken down on February 23, 2014. Group two announcements and participation were finalized on February 21, 2014.

Group One participants interacted with agricultural data in the form of an online website at the location and time of their own discretion. The following is the procedure for those individuals:

1. Participants were asked to take an online pretest used to survey initial use and value of information sources. Once the pretest was completed, a link was provided for individuals to view a website composed of a categorized portion of agricultural data.
2. Participants analyzed a website composed of a categorized portion of agricultural data. Individuals were asked to carefully read and analyze the website for future referencing. Once analysis was completed, a link was provided for individuals to proceed to a posttest.
3. Participants were asked to take an online posttest to survey reaction, perception, and retentiveness of previous agricultural data provided on the website.

Once all three steps were completed, individuals were thanked and allowed to close their browser. The study engaged participants for approximately 15 to 30 minutes.

Group Two participants interacted with agricultural data in the form of an online website in either the Kleberg or College of Agriculture and Life Sciences buildings during available day slots. The following is the procedure for those individuals:

1. Participants were asked to take an online pretest to survey initial use and value of information sources. Once the pretest was completed, a link was provided for individuals to view a website composed of a categorized portion of agricultural data.
2. Participants analyzed a website composed of a categorized portion of agricultural data. Individuals were asked to carefully read and analyze the website for future referencing. Once analysis was completed, a link was provided for individuals to proceed to a posttest.
3. Participants were asked to take an online posttest to survey reaction, perception, and retentiveness of previous agricultural data provided on the website.

Once all three steps were completed, individuals were thanked and allowed to leave the station. The study engaged participants for approximately 15 to 30 minutes.

3.9 Survey Error

Low response rate to the online questionnaires was seen, despite utilizing Dillman Tailored Design Method (2007). It has been seen though that when only one response option is given, mail response rates are much higher than online responses (Nocella, Hubbard, & Riccardo, 2010; Schonlau, Fricker, & Elliot, 2002). With this knowledge, this research study may have seen a higher response rate if it had used a combination of mailed and emailed questionnaires. Participants from both sample groups addressed the investigators indicating they were not eligible, did not wish to participate or did not receive an initial email to partake in the study. Of the ~5,200 individuals contacted in Group One, a sample group of 318 responded within the two week survey period. Approximately 500 to 600 respondents did not receive an email due to an invalid email address. Of the individuals contacted in Group Two, a sample group of 106 participated within the two week survey period.

Even though response rate was low, the data obtained was still deemed acceptable for use as a case study approach. It has been noted that there is no substantial effect of lower response rates with opinion measurements (Langer, 2003). Also, it has been stated that those who respond are more likely to be a better representative of the target audience and overall more accurate than non-respondents (Gillespie, 2009; Miller & Carr, 1997).

Coverage, sampling, measurement, and nonresponse errors can affect precision and accuracy of self-administered surveys (Dillman, 2007). Coverage error results in

samples in the population having no chance for selection, others having multiple chances and some samples not qualifying for surveying (Keusch, 2011; Dillman, Totora, Conrad, & Bowker, 1998). Sampling error is derived from surveying only a portion of the population rather than the entire population (Keusch, 2011; Bowker et al., 1999). Measurement error is due to inaccurate answers from poor question wording, interviewing, mode effects and behavior of respondents (Keusch, 2011; Bowker et al., 1999). Nonresponse error occurs when individuals in the sample group do not respond to the survey request which ties into the previously stated low response (Keusch, 2011; Bowker et al., 1999). This study focused on all four errors.

Coverage and sampling error applied to the population and division of said population for this study. In general, individuals in a higher learning environment were contacted. Based on this, individuals not within this environment were excluded. Along with this exclusion factor, individuals without a valid email address, not within the College of Agriculture and Life Sciences and Extension environments or not based in Kleberg or the College of Agriculture and Life Sciences buildings were excluded. Group One individuals used the exclusion factors of valid email address and within an agricultural college or extension. In terms of a valid email address it is however noted that a population without universal Internet access can be immaterial for some studies (Nocella, Hubbard, & Riccardo, 2010; Schonlau, Fricker, & Elliot, 2002).

Lastly, Group Two individuals used the exclusion factor of location within either the College of Agriculture or Life Science or Kleberg buildings. Measurement error was attempted to be avoided through examining and editing questions to ensure wording was

correct. However, respondent answering behavior could not be avoided, but was taken into account. This study could not prevent all errors due to its broad scope, yet these errors were taken into consideration during data analysis.

As stated earlier, the purpose of this study was to determine where agricultural data is acquired by individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments and adoption attitude towards utilizing new a media form for acquiring agricultural data. Objectives observed during this study are as follows:

1. Identify agricultural knowledge levels.
2. Identify commonly used information sources for agricultural knowledge acquisition.
3. Identify adoption attitude towards using an information source to acquire agricultural information.
4. Compare individuals', in an agriculturally-related occupation in Texas and 18 years of age or older involved with or within Texas agricultural higher education or extension environments, adoption attitudes towards using an online information source.

3.10 Data Analysis

Data analysis was performed using the computer software, SPSS (Statistical Package for the Social Science). Both sample groups served as independent variables to develop analysis of information sources used as dependent variables for cross-tabulation between the two groups. Descriptive statistical analysis was used to observe each groups' pre and post-tests. Differences between the groups' tests were analyzed using a t-test analysis. Relationships between the groups' tests were analyzed using correlation analysis. For each sample groups' posttest, content analysis of open-ended questions occurred. When manifest and/or latent content was found, it was analyzed to further explain quantitative data acquired.

CHAPTER IV

FINDINGS, DATA ANALYSIS, AND RESULTS

4.1 Objectives

This chapter focuses on findings from this study. Results will be discussed as they pertain to the following established objectives:

1. Identify agricultural knowledge levels.
    1A. Identify agricultural knowledge levels of individuals in an agriculturally-related occupation in Texas compared to non-agriculturally minded consumers.
    1B. Identify agricultural knowledge levels of individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments compared to non-agriculturally minded consumers.
    1C. Compare agricultural knowledge levels of individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments to non-agriculturally minded consumers.
2. Identify commonly used information sources for agricultural

knowledge acquisition.

2A. Identify commonly used information sources for agricultural knowledge acquisition by individuals in an agriculturally-related occupation in Texas.

2B. Identify commonly used information sources for agricultural knowledge acquisition by individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments.

2C. Compare commonly used information sources for agricultural knowledge acquisition by individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within agricultural higher education or extension environments.

3. Identify adoption attitude towards using an information source to acquire agricultural information.

3A. Identify adoption attitude of individuals in an agriculturally-related occupation in Texas towards using an information source to acquire agricultural information.

3B. Identify adoption attitude of individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments towards using an information source to acquire agricultural information.

3C. Compare adoption attitudes of individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments towards using an information source to acquire agricultural information.

4. Compare individuals', in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments, adoption attitudes towards using an online informational source.

4.2 Research Findings

During the study's timeframe, 318 questionnaires from individuals in an agriculturally-related occupation in Texas (Group One) were received. Of the 318 responses, 307 questionnaires were reported as usable. Out of the usable 307, 241 questionnaires were fully completed. Individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments (Group Two) were also surveyed. A total of 106 questionnaires from Group Two were received. All 106 were fully completed. The following personal and professional results varied due to respondents' permission to skip questions that did not apply to them. Of the 241 Group One completed questionnaires, gender response consisted of 39% (n = 124) females and 37% (n = 117) males. Group Two gender response consisted of 51% (n = 54) females

and 38% (n = 40) males. Group One's most notable age responses were 24% (n = 69) between 35 to 54 and 22% (n = 69) between 26 and 34. Group Two age response consisted of a majority (83%, n = 88) between 18 and 25. A majority of 66% (n = 211) reported an ethnicity of White only for Group One. A majority of 71% (n = 75) reported an ethnicity of White only for Group Two. Nearly all individuals in Group One reported current residence in Texas (75%, n = 237). Other states of residency reported (1%, n = 4) were Colorado, Florida, North Dakota and Hawaii. A total 94 (89%) respondents from Group Two reported current state residency in Texas. Highest educational levels reported by Group One consisted of 71 respondents having a Master's degree, 71 respondents having a Doctoral degree, and 69 respondents being a college graduate. Each of these educational levels were approximately 22% of the entire sample group. Educational level for Group Two consisted of a 68% (n = 72) majority having some college.

Group One's agricultural professional data consisted of a response majority of 47% (n = 144) reporting an occupation as a professional and/or associate professional. Respondents answered about their Agricultural Area of Occupation (currently in). Respondents may have chosen more than one area for their occupation. Of the responses acquired, a high of 25% (n = 78) reported an occupation in produce crops and 24% (n = 74) reported an occupation in beef cattle. Most common occupation responses for Group Two were 52% (n = 55) reporting none of the above, 22% (n = 23) reporting an occupation as a farmer or rancher, and 20% (n = 21) reporting an occupation as a laborer or helper. Of the Group Two responses acquired, a majority of 19% (n = 20) reported an

occupation in beef cattle. Group Two respondents were also asked to report about an agricultural area they planned to enter. 10% (*n* = 11) responded planning to enter the area of beef cattle. 15% (*n* = 16) reported planning to enter some other area of agriculture. Most common responses were in the area of equine. Group One had a majority of 54% (*n* = 172) of respondents report not to owning a ranch, farm, or agriculturally-related business along with or without their agricultural occupation. Only 22% (*n* = 70) of Group One responded yes to owning an agriculturally-related business. Of the 70 responses, a majority (17%, *n* = 55) of businesses reported residence in Texas. Other states reported were Illinois, New Mexico, Oklahoma, Tennessee and Non-United States. Respondents also reported a majority (13%, n = 41) of businesses were in beef cattle. Only 20% (*n* = 21) of Group Two respondents reported owning a ranch, farm, or agriculturally-related business, while 67% (*n* = 71) reported no to owning one. 16% (*n* = 17) of Group Two reported business residence in Texas and a majority of 14% (*n* = 15) reported their business was in beef cattle. Lastly, 60% (*n* = 183) of Group One reported their employment status as full time. Employment for Group Two responses was 76% (*n* = 81) reporting status as a student and 29% (*n* = 31) reporting a status as a part time. See Table 1 for a summary of data regarding Group One and Two's personal and professional demographics.

Table 1

Group One and Two Demographics

	Group One (N = *318*)		Group Two (N = *106*)	
Demographics	*n*	*%*	*n*	*%*
Gender				
Female	124	39	54	51
Male	117	37	40	38
Age				
Under 18	0	0	0	0
18 to 25	42	13	88	83
26 to 34	69	22	4	4
35 to 54	76	24	0	0
55 to 64	43	14	0	0
65 or Over	12	4	2	2
Ethnicity				
White Only	211	66	75	71
American Indian Only	0	0	0	0
Asian Only	2	1	0	0
Black Only	1	0	1	1
Hispanic or Latino	12	4	13	12
Native Hawaii Only	0	0	0	0
2 or More (Excl. Black)	6	2	4	4
International	2	1	0	0
Unknown or NR	6	2	0	0
State of Residence				
Texas	237	75	94	89
Other	4	1	0	0

Table 1 (continued)

Demographics	Group One (N = *318*)		Group Two (N = *106*)	
	n	*%*	*n*	*%*
Educational Level				
Grammar School	0	0	0	0
High School or EQV	3	1	10	9
2 yr. (VOC / TECH)	1	0	1	1
Some College	15	5	72	68
College Grad. (4 yr.)	69	22	9	9
Master's (MS)	71	22	2	2
Doctoral (PhD)	71	22	0	0
Professional (MD)	8	3	0	0
Other	1	0	0	0
Occupation				
Professional	144	47	5	5
Official or Manager	17	6	5	5
Technician	30	10	1	1
Admin. Support Worker	0	0	2	2
Craft Worker	0	0	2	2
Operative	6	2	1	1
Laborer or Helper	11	4	21	20
Sales Worker	2	1	8	8
Service Worker	3	1	8	8
Farmer or Rancher	43	14	23	22
None of the Above	48	16	55	52

Table 1 (continued)

Demographics	Group One (N = *318*)		Group Two (N = *106*)	
	n	*%*	*n*	*%*
Ag Area of Occupation				
Beef Cattle	74	24	20	19
Dairy Cattle	22	7	3	3
Hog & Pig	35	11	6	6
Poultry & Egg	25	8	5	5
Aquaculture	20	7	0	0
Sheep & Goat	41	13	7	7
Other	49	16	12	11
Produce Crops	78	25	6	6
Green. & Nurs.	35	11	0	0
Forestry	14	5	0	0
Chem., Pest., & Fert.	46	15	4	4
Ag Area (Plan to Enter)				
Beef Cattle	0	0	11	10
Dairy Cattle	0	0	5	5
Hog & Pig	0	0	2	2
Poultry & Egg	0	0	2	2
Aquaculture	0	0	0	0
Sheep & Goat	0	0	4	4
Other	0	0	16	15
Produce Crops	0	0	5	5
Green. & Nurs.	0	0	2	2
Forestry	0	0	2	5

Table 1 (continued)

Demographics	Group One (N = *318*)		Group Two (N = *106*)	
	n	*%*	*n*	*%*
Ag Area (Plan to Enter)				
Chem., Pest., & Fert.	0	0	3	3
Ag Business Ownership				
Yes	70	22	21	20
No	172	54	71	67
State of Ag Business				
Texas	55	17	17	16
Other	7	2	1	1
Ag Area of Business				
Beef Cattle	41	13	15	14
Dairy Cattle	1	3	5	5
Hog & Pig	7	2	3	3
Poultry & Egg	5	2	5	5
Aquaculture	2	1	0	0
Sheep & Goat	14	5	9	9
Other	12	4	8	8
Produce Crops	21	7	4	4
Green. & Nurs.	3	1	0	0
Forestry	2	1	1	1
Chem., Pest., & Fert.	3	1	2	2
Employment				
Full Time	183	60	9	9
Part Time	37	12	31	29

Table 1 (continued)

	Group One (N = *318*)		Group Two (N = *106*)	
Demographics	*n*	*%*	*n*	*%*
Employment				
Retired	6	2	0	0
Unemployed	1	0	4	4
Graduate Student	38	12	0	0
Student	0	0	81	76

Note. "Green. & Nurs." = Greenhouse & Nursery. "Chem., Pest., & Fert." = Chemical, Pesticide, & Fertilizer. Note. Percentages due not equal 100% due to rounding.

4.2.1 Findings Related to Objective 1

Objective 1A identified respondents', in an agriculturally-related occupation in Texas, agricultural knowledge levels compared to non-agriculturally minded consumers. Survey question one asked participants to rank their knowledge level of livestock, crop, and chemical, pesticide, and fertilizer production on a five point Likert-type scale from least knowledgeable (1) to much higher (5). Question one was a sorter question separating respondents into three respective groups, livestock, crop, and chemical, pesticide, and fertilizer production minded individuals. Individuals could be knowledgeable in a respective production area or any combination of the three.

Of the 307 qualifying surveys, 287 responses were collected about livestock production knowledge levels with a mean of 4 (Higher). Of the 287 responses collected, 42.9% (*n* = 123) reported having a higher (4) knowledge level and 38.7% (*n* = 111)

reported having a much higher (5) knowledge level than a non-agriculturally minded consumer. 292 responses were collected about crop production knowledge levels with a mean of 4 (Higher). Out of the responses, 44.9% (n = 131) reported having a higher (4) knowledge level and 36.6% (n = 107) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. Individuals that reported a higher (4) or much higher (5) knowledge level were provided a second sorter question to determine subareas of livestock or crop production specialization was in. Individuals that reported a knowledge level either much lower (1), slightly lower (2) or about the same (3) were not deemed knowledgeable in an area and not provided questions pertaining to the main production area. Lastly, 283 respondents reported knowledge levels about chemical, pesticide and fertilizer production with a mean of 4 (Higher). 41% (n = 131) reported having a higher (4) knowledge level and 27% (n = 87) responded having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. This question was the only sorter question pertaining to its field.

Following question one, questions two and three were sub-sorter questions that grouped respondents into their respective knowledge subareas for further relative questioning. Subarea knowledge levels were in either livestock or crop production. Respondents could have been provided subarea questions for both fields if they reported having a higher (4) or much higher (5) in each. Question two pertained to livestock production and presented individuals with the following subareas: beef cattle, dairy cattle, hog and pig, poultry and egg, aquaculture, sheep and goat, and other. Other subarea respondents were given an opportunity to report their answer through written

response. Question three pertained to crop production and presented individuals with the following subareas: produce crops, greenhouse and nursery, and forestry.

Of the 287 respondents to question one about livestock production, 82% (*n* = 234) were deemed knowledgeable. Out of the 82%, 226 responded about their knowledge level of the beef cattle industry with an average knowledge level response of 5 (Much Higher). 31% (*n* = 100) reported having a higher (4) knowledge level and 36% (*n* = 114) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. 225 respondents answered about their knowledge level of dairy cattle production with an average knowledge level response of 4 (Higher). A majority of 43% (*n* = 136) reported having a higher (4) knowledge level and only 15% (*n* = 47) reported having a higher much (5) knowledge level than that of a non-agriculturally minded consumer. For the subarea of hog and pig production, 226 respondents reported about their knowledge level with an average knowledge level response of 4 (Higher). 37% (*n* = 118) reported having a higher (4) knowledge level and 19% (*n* = 61) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. 225 respondents reported about their knowledge level of poultry and egg production with a mean of 4 (Higher). Of the 225 respondents, 42% (*n* = 134) reported having a higher (4) knowledge level and 13% (*n* = 42) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. Another 225 respondents reported about their knowledge levels for aquaculture with an average knowledge level response of 3 (About the Same). 33% (*n* = 104) reported having a knowledge level that was about the same (5) as a non-

agriculturally minded consumer. 29% (*n* = 93) reported having a higher (4) knowledge level and only 7% (*n* = 22) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. Another 225 respondents reported about their knowledge level of sheep and goat production with an average knowledge level response of 4 (Higher). 36% (*n* = 113) reported having a higher (4) knowledge level, while only 18% (*n* = 57) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer. Lastly, 224 respondents reported about their knowledge of other production areas with an average knowledge level response of 4 (Higher). 36% (*n* = 114) reported having a higher (4) knowledge level. Only 16% (*n* = 51) reported having a much higher (5) knowledge level in another area of livestock production, while 18% (*n* = 57) reported having a knowledge level that was about the same (3). Individuals that reported having a higher (4) or much higher (5) knowledge level in another area were able to indicate their answer through written responses. Common responses were equine, food safety, bioengineering, communication, finance, wildlife, veterinary medicine and small animal production.

In regards to the 292 responses about crop production knowledge levels, 82% (*n* = 238) were deemed knowledgeable. Out of the 82%, 206 respondents answered about their knowledge level of produce crops with a mean of 4 (Higher). Of the 230 respondents, 38% (*n* = 122) reported having a higher (4) knowledge level and 26% (*n* = 84) reported having a much higher (5) knowledge level than a non-agriculturally minded consumer. A total of 233 respondents reported about their knowledge level of greenhouse and nursery production with an average knowledge level response of 4

(Higher). Of the 233 responses, 37% (n = 117) reported having a higher (4) knowledge level and 19% (n = 59) reported having a much higher (5) knowledge level than a non-agriculturally minded consumer. Lastly, 228 respondents answered about their knowledge of forestry production with an average knowledge level response of 3 (About the Same). Out of the 228 respondents, 35% (n = 112) reported their knowledge level was about the same (3) as a non-agriculturally minded consumer. 24% (n = 77) reported having a higher (4) knowledge level and 12% (n = 37) reported having a much higher (5) knowledge level than that of a non-agriculturally minded consumer.

Individuals that stated they had a much lower (1), lower (2) or about the same (3) knowledge level about an agricultural subarea were not provided any further questions relative to it. Respondents whom stated having a higher (4) or much higher (5) knowledge level in a subarea were provided relevant subarea questions pertaining to Objective 2A.

Objective 1B identified respondents', 18 years of age or older involved with or within Texas agricultural higher education or extension environments (Group Two), agricultural knowledge levels compared to non-agriculturally minded consumers. Survey question one asked participants to rank their knowledge level of livestock, crop, and chemical, pesticide, and fertilizer production on a five point Likert-type scale from much lower (1) to much higher (5). Question one was a sorter question that separated respondents into three respective groups: livestock, crop, and chemical, pesticide and fertilizer production minded individuals. Individuals could be knowledgeable in each respective area or any combination of the three.

Of the 106 qualifying surveys, 94 responses were collected about their livestock production knowledge level with an average knowledge level response of 4 (Higher). Of the 94 respondents, 42% (n = 44) reported having a higher (4) than a non-agriculturally minded consumer. Only 19% (n = 20) reported having a knowledge level that was much higher (5) than a non-agriculturally minded consumer. 89 respondents reported their knowledge level about crop production with an average knowledge level response of 4 (Higher). A majority of 41% (n = 43) reported having higher (4) knowledge level and only 2% (n = 2) reported their knowledge level was much higher (5) than that of a non-agriculturally minded consumer. 25% (n = 26) reported having a knowledge level that was about the same (3) as a non-agriculturally minded consumer. 90 knowledge level responses were collected about chemical, pesticide, and fertilizer production with an average knowledge level response of 3 (About the Same). 30% (n = 32) reported having a higher (4) knowledge level. 32% (n = 34) reported having a knowledge level that was about the same (3) as a non-agriculturally minded consumer. Zero respondents reported having a much higher (5) knowledge level. This question was the only sorter question pertaining to this field.

Procedure followed the same guidelines reported in Objective 1A. Following question one, questions two and three were sub-sorter questions that grouped respondents into their respective knowledge subareas for further relative questioning. Subarea knowledge levels were in either livestock or crop production. Respondents could have been provided subarea questions for both fields if they reported having a higher (4) or much higher (5) in each. Question two pertained to livestock production

and presented individuals with the following subareas: beef cattle, dairy cattle, hog and pig, poultry and egg, aquaculture, sheep and goat, and other. Other subarea respondents were given an opportunity to report their answer through written response. Question three pertained to crop production and presented individuals with the following subareas: produce crops, greenhouse and nursery, and forestry.

Of the 94 respondents about livestock production knowledge levels, 68% (n = 64) were deemed knowledgeable. Out of the 68%, 63 respondents stated about their knowledge level of the beef cattle industry with an average knowledge level response of 5. 34% (n = 36) reported having a higher (4) knowledge level and 23% (n = 24) reported having a much higher (5) knowledge level than a non-agriculturally minded consumer. 62 respondents reported about their knowledge level of dairy cattle production with an average knowledge level response of 4 (Higher). 34% (n = 36) reported having a higher (4) knowledge level and 11% (n = 12) reported having a much higher (5) than a non-agriculturally minded consumer. For the subarea of hog and pig production, 63 respondents reported about their knowledge level with an average knowledge level response of 4 (Higher). 18% (n = 18) reported having a knowledge level that was about the same (3) as a non-agriculturally minded consumer. 34% (n = 36) reported having a higher (4) knowledge level and only 9% (n = 9) reported their knowledge level was much higher (5) than a non-agriculturally minded consumer. 61 respondents reported about their knowledge level of poultry and egg production with a mean of 4 (Higher). Of the 61 respondents, 13% (n = 14) reported having a knowledge level that was about the same (3) as a non-agriculturally minded individual. 34% (n = 36) reported having a

higher (4) knowledge level and only 8% (n = 8) reported their knowledge level was much higher (5) than a non-agriculturally minded consumer. For the subarea of aquaculture, 61 respondents reported about their knowledge level with a mean of 3 (About the Same). A majority 43% (n = 46) reported their knowledge level was about the same (3) as a non-agriculturally minded consumer. Only 5% (n = 5) reported having a higher (4) knowledge level and only 1% (n = 1) reported having a much higher (5) knowledge level than a non-agriculturally minded consumer. 62 respondents answered about their knowledge level of sheep and goat production with an average knowledge level response of 4 (Higher). Of the respondents, 26% (n = 27) reported having a higher (4) knowledge level and 21% (n = 22) reported their knowledge level was about the same (3) as a non-agriculturally minded consumer. Only 11% (n = 12) reported having a much higher (5) knowledge level. Another 62 respondents answered about their knowledge level of other livestock production with an average knowledge level response of 4 (Higher). 21% (n = 22) reported their knowledge of other livestock was about the same (3) as non-agriculturally minded consumers. 25% (n = 26) reported having a higher (4) knowledge level and only 11% (n = 12) reported having a much higher (5) knowledge level in another area of livestock production. Individuals that answered they had a higher (4) or much higher (5) knowledge level in another livestock area were able to indicate their answer through written responses. The most common response was equine production.

Out of the 89 responses for knowledge level about crop production, 51% (n = 43) were deemed knowledgeable. Of the 51%, 43 respondents answered about their

knowledge level of produce crops with a mean of 4 (Higher). Out of the 43 responses, 11% (n = 12) reported having a knowledge level about the same (3) as a non-agriculturally minded consumer. A majority of 27% (n = 29) reported having a higher (4) knowledge, while only 2% (n = 2) reported their knowledge level was much higher (5) than a non-agriculturally minded consumer. 44 respondents reported their knowledge level about greenhouse and nursery production with an average knowledge level response of 4 (Higher). Of the 44 respondents, 27% (n = 29) reported their knowledge level was about the same (3) as a non-agriculturally minded consumer. 10% (n = 11) reported having a higher (4) knowledge level and only 3% (n = 3) reported having a much higher (5) knowledge level than a non-agriculturally minded consumer. Lastly, 43 respondents reported about their knowledge level of forestry production with a mean of 3 (About the Same). Out of the 43 respondents, 24% (n = 25) reported having a knowledge level about the same (3) as a non-agriculturally minded consumer. 15% (n = 16) reported having a higher (4) knowledge level and 41% (n = 43) reported having a much higher (5) knowledge level than a non-agriculturally minded consumer.

Group Two respondents whom stated they had a much lower (1), lower (2) or about the same (3) knowledge level about an agricultural subarea were not provided any further questions relative to it. Respondents whom stated having a higher (4) or much higher (5) knowledge level in a subarea were provided relevant subarea questions pertaining to Objective 2B. See Table 2 for summary of data regarding Group One and Two knowledge levels for all areas and subareas of agriculture production. See Table 3

for a summary of data regarding average Group One and Two knowledge levels for all areas and subareas of agricultural production.

Table 2

Group One and Two Knowledge Levels

		Knowledge Level Scale									
		1		2		3		4		5	
Area		*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
LIST											
	One	9	3	2	1	42	13	123	39	111	35
	Two	7	7	8	8	15	14	44	42	20	19
CRPR											
	One	4	1	8	3	42	13	131	41	107	34
	Two	5	5	13	12	26	25	43	41	2	2
CHPF											
	One	6	2	4	1	55	17	131	41	87	27
	Two	12	11	12	11	34	32	32	30	0	0
BECA											
	One	0	0	0	0	12	4	100	31	114	36
	Two	0	0	0	0	3	3	36	34	24	23
DACA											
	One	0	0	3	1	39	12	136	43	47	15
	Two	0	0	1	1	13	12	36	34	12	11

Table 2 (continued)

		Knowledge Level Scale									
		1		2		3		4		5	
Area		*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
HOPI											
	One	1	0	2	1	44	14	118	37	61	19
	Two	0	0	0	0	18	17	36	34	9	9
POEG											
	One	2	1	0	0	47	15	134	42	42	13
	Two	1	1	2	2	14	13	36	34	8	8
AQUA											
	One	2	1	4	1	104	33	93	29	22	7
	Two	2	2	7	7	46	43	5	5	1	1
SHGO											
	One	0	0	2	1	53	17	113	36	57	18
	Two	0	0	2	2	22	21	27	26	11	10
OTHR											
	One	1	0	1	0	57	18	114	36	51	16
	Two	0	0	2	2	22	21	26	25	12	11
PRCR											
	One	0	0	0	0	24	8	122	38	84	26
	Two	0	0	0	0	12	11	29	27	2	2
GHNU											
	One	0	0	1	0	56	18	117	37	59	19
	Two	0	0	1	1	29	27	11	10	3	3

Table 2 (continued)

		Knowledge Level Scale									
		1		2		3		4		5	
Area		*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
FORE											
	One	0	0	2	1	112	35	77	24	37	12
	Two	0	0	2	2	25	24	16	15	43	41

Note. Area abbreviations are as follows: LIST = Livestock. CRPR = Crop Production. CHPF = Chemical, Pesticide and Fertilizer. BECA = Beef Cattle. DACA = Dairy Cattle. HOPI = Hog and Pig. POEG = Poultry and Egg. AQUA = Aquaculture. SHGO = Sheep and Goat. OTHR = Other Area. PRCR = Produce Crops. GHNU = Greenhouse and Nursery. FORE = Forestry. Note. Knowledge Level Likert Scale numbers are as follows: 1 = Much Lower. 2 = Slightly Lower. 3 = About the Same. 4 = Higher. 5 = Much Higher. Note. Percentages do not equal 100% due to rounding.

Table 3

Averages of Group One and Two Knowledge Levels

	Agriculture Area & Subarea												
Group	LIST	CRPR	CHPF	BECA	DACA	HOPI	POEG	AQUA	SHGO	OTHR	PRCR	GHNU	FORE
One													
M	4	4	4	5	4	4	4	4	4	4	4	4	4
SD	0.9	0.9	0.9	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.8

Table 3 (continued)

Group	Agriculture Area & Subarea												
	LIST	CRPR	CHPF	BECA	DACA	HOPI	POEG	AQUA	SHGO	OTHR	PRCR	GHNU	FORE
Two													
M	4	3	3	4	4	4	3	4	4	4	4	3	3
SD	1.1	0.9	1	0.6	0.7	0.6	0.8	0.6	0.8	0.8	0.5	0.7	0.6

Note. Group One α = .85. Group Two α = .72. Note. Area abbreviations are as follows: LIST = Livestock. CRPR = Crop Production. CHPF = Chemical, Pesticide and Fertilizer. BECA = Beef Cattle. DACA = Dairy Cattle. HOPI = Hog and Pig. POEG = Poultry and Egg. AQUA = Aquaculture. SHGO = Sheep and Goat. OTHR = Other Area. PRCR = Produce Crops. GHNU = Greenhouse and Nursery. FORE = Forestry. Note. Knowledge Level Likert Scale numbers are as follows: 1 = Much Lower. 2 = Slightly Lower. 3 = About the Same. 4 = Higher. 5 = Much Higher.

Objective 1C compared Group One and Two knowledge levels through independent samples t-test as they related to non-agriculturally minded consumers. Comparing Group One and Two livestock production knowledge levels resulted in a t-value of 4 and a two-tailed significance of 0.00. Comparison of crop production knowledge levels resulted in a t-value of 8 and a two-tailed significance of 0.00. Chemical, pesticide, and fertilizer comparison resulted in a t-value of 9 and a two-tailed significance of 0.00. Beef cattle knowledge level comparison resulted in a t-value of 1 and a two-tailed significance of 0.15. Dairy cattle knowledge level comparison resulted in a t-value of 1 and a two-tailed significance of 0.56. Comparison of hog and pig knowledge level resulted in a t-value of 2 and a two-tailed significance of 0.05. Aquaculture knowledge level comparison resulted in a t-value of 7 and a two-tailed

significance of 0.00. Sheep and goat knowledge level comparison resulted in a t-value of 2 and a two-tailed significance of 0.03. Other areas of knowledge level comparison resulted in a t-value of 2 and a two-tailed significance of 0.12. Produce crop knowledge level comparison resulted in a t-value of 5 and a two-tailed significance of 0.00. Comparison of greenhouse and nursery knowledge levels resulted in a t-value of 6 and a two-tailed significance of 0.00. Lastly, forestry knowledge level comparison resulted in a t-value of 3 and a two-tailed significance of 0.00. See Table 4 for a complete summary of data in regards to t-test comparison Group One and Two knowledge levels.

Table 4

Comparison of Group One and Two Knowledge Levels

	Group One (N = *318*)		Group Two (N = *106*)				
Area	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*
LIST	4	0.9	4	1.1	135	4	0.00
CRPR	4	0.9	3	0.9	135	8	0.00
CHPF	4	0.9	3	1.0	133	9	0.00
BECA	5	0.6	4	0.6	103	1	0.15
DACA	4	0.7	4	0.7	94	1	0.56
HOPI	4	0.7	4	0.6	111	2	0.05
POEG	4	0.7	3	0.8	87	2	0.13
AQUA	4	0.7	4	0.6	108	7	0.00

Table 4 (continued)

	Group One (N = *318*)		Group Two (N = *106*)				
Area	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*
SHGO	4	0.7	4	0.8	92	2	0.03
OTHR	4	0.7	4	0.8	92	2	0.12
PRCR	4	0.6	4	0.5	67	5	0.00
GHNU	4	0.7	3	0.7	64	6	0.00
FORE	4	0.8	3	0.6	75	3	0.00

Note. Group One and Two α = .85. Note. Area abbreviations are as follows: LIST = Livestock. CRPR = Crop Production. CHPF = Chemical, Pesticide and Fertilizer. BECA = Beef Cattle. DACA = Dairy Cattle. HOPI = Hog and Pig. POEG = Poultry and Egg. AQUA = Aquaculture. SHGO = Sheep and Goat. OTHR = Other Area. PRCR = Produce Crops. GHNU = Greenhouse and Nursery. FORE = Forestry. Note. Knowledge Level Likert Scale numbers are as follows: 1 = Much Lower. 2 = Slightly Lower. 3 = About the Same. 4 = Higher. 5 = Much Higher. Note. T-values rounded to whole number.

4.2.2 Findings Related to Objective 2

Objective 2A aimed to identify commonly used information sources for Group One. After completion of first three sorter questions, knowledgeable respondents in any area or subarea were asked to report any sources used to acquire agricultural knowledge. Respondents may have been knowledgeable in any combination of area or subareas. Utilizing a five point Likert-Type scale for each respective source, individuals ranked, from never (1) to almost always (5), their likelihood of utilizing a given source for obtaining agricultural knowledge.

Area and subarea knowledgeable respondents were given fourteen sources to report about use. The fourteen mediums were categorized into the following: print, broadcast, digital, and inner-personal. Print represented books, extension papers, and magazines. Broadcast represented television and radio, and digital represented enewsletters and websites and/or blogs. Lastly, inner-personal represented college courses, extension personnel, family, first-hand experience, FFA, 4-H, and industry specific organizations. Respondents' answers were grouped into the four stated areas.

A total of 254 respondents reported using print sources. Average response for print use was 3 (Sometimes) with a standard deviation of 0.8. 253 respondents reported digital source use with an average response of 3 (Sometimes) and standard deviation of 0.9. 252 respondents reported about broadcast source use with an average response of 2 (Seldom) and standard deviation of 0.7. 256 respondents reported about personal source with an average response of 3 (Sometimes) and standard deviation of 0.7.

Responses were categorized into two major groups. Personal remained the same combining college courses, extension personnel, family, first-hand experience, FFA, 4-H, and industry specific organizations. Second group created was media enveloping books, extension papers, magazines, television, radio, enewsletters, and websites and/or blogs. As stated before, 256 respondents reported personal source use with an average response of 3 (Sometimes) and standard deviation of 0.7. 254 respondents reported about media source use with an average of 2 (Sometimes) and standard deviation of 0.7.

Beef cattle knowledgeable respondents reported first-hand experience as the most commonly used source to acquire knowledge. This information source held an average

response of 4 (Often). Radio, television, and the FFA organization were ranked lowest with an average response of 2 (Seldom). Lastly, all other sources were reported with an average response rate of 1 (Never). Dairy cattle knowledgeable respondents reported first-hand experience, extension papers, magazines, websites and/or blogs, extension personnel and industry specific organizations as the most commonly used sources for acquiring knowledge. Each held an average response rate of 3 (Sometimes). All other sources used held an average response rate of 2 (Seldom). Hog and pig knowledgeable respondents reported first-hand experience, extension papers, magazines, websites and/or blogs, family, extension personnel, college courses, and industry specific organizations as the most commonly used sources for acquiring knowledge. Each held an average response rate of 3 (Sometimes). All other sources used held an average of response rate of 2 (Seldom). Poultry and egg knowledgeable respondents reported first-hand experience, extension papers, websites and/or blogs, and extension personnel as the most commonly used sources to acquire knowledge. Again, each of these held a response rate of 3 (Sometimes) and all other sources used held an average response rate of 2 (Seldom). Aquaculture knowledgeable respondents reported extension papers, websites and/or blogs, and extension personnel as the most commonly used sources for acquiring knowledge. Each held an average response rate of 3 (Sometimes). The 4-H organization was reported as the least commonly used source for acquiring information with an average response rate of 1 (Never). All other sources held an average response rate of 2 (Seldom). Sheep and goat knowledgeable respondents reported an average response rate of 3 (Sometimes) for a half of sources used. Second half of common

information sources used held an average response rate of 2 (Seldom). Other area knowledgeable respondents reported first-hand experience as the most commonly used source with an average response rate of 4 (Often). Enewsletters, television, radio, the FFA organization and the 4-H organization were reported as the least commonly used sources to acquire knowledge. Each held an average response rate of 2 (Seldom). Lastly, all other sources were reported with an average response rate of 3 (Sometimes). Produce crop knowledgeable respondents reported first-hand experience as the most commonly used source with an average response rate of 4 (Often). Television, radio, the FFA organization and the 4-H organization were reported as the least commonly used sources for acquiring knowledge. Each held an average response rate of 2 (Seldom). All other sources were reported with an average response rate of 1(Never). Greenhouse and nursery knowledgeable respondents reported first-hand experience as the most commonly used source for acquiring knowledge with an average response rate of 4 (Often). Enewsletters, television, radio, family, the FFA organization and the 4-H organization were reported as least utilized sources each holding an average response rate of 2 (Seldom). All other sources were reported with an average response rate of 3 (Sometimes). Forestry knowledgeable respondents reported half sources with an average response rate of 3 (Sometimes) and the other half with an average response rate of 2 (Seldom). Lastly, chemical, pesticide, and fertilizer knowledgeable respondents reported first-hand experience as the most commonly used source to acquire knowledge with an average response rate of 4 (Often). The FFA organization and the 4-H organization were reported as the least commonly used sources with each holding an average response rate

of 1 (Never). Enewsletters, television, radio and family were reported as the second least commonly used sources with each holding an average response rate of 2 (Seldom). All other sources used were reported with an average response rate of 3 (Sometimes).

Objective 2B aimed to identify commonly used information sources for Group One. Following the same guidelines as Objective 2A, after completion of first three sorter questions, knowledgeable respondents in any area or subarea were asked to report any sources used to acquire agricultural knowledge. Respondents may have been knowledgeable in any combination of area or subareas. Utilizing a five point Likert-Type scale for each respective source, respondents ranked, from never (1) to almost always (5), their likelihood of utilizing a given source for obtaining agricultural knowledge.

Area and subarea knowledgeable respondents were given fourteen sources to report about use. The fourteen mediums were categorized into the following: print, broadcast, digital, and inner-personal. Print represented books, extension papers, and magazines. Broadcast represented television and radio, and digital represented enewsletters and websites and/or blogs. Lastly, inner-personal represented college courses, extension personnel, family, first-hand experience, FFA, 4-H, and industry specific organizations. Respondents' answers were grouped into the four stated areas.

A total of 69 respondents reported using print sources with an average response rate of 2 (Seldom) and standard deviation of 0.7. 68 respondents also reported about digital source use with an average response of 2 (Seldom) and standard deviation of 0.7. 69 respondents reported about broadcast source use with an average response rate of 2

(Seldom) and standard deviation of 0.8. Lastly, 69 respondents reported about personal source use with an average response rate of 3 (Sometimes) and standard deviation of 0.7.

Responses were categorized into two major groups. Personal remained the same combining college courses, extension personnel, family, first-hand experience, FFA, 4-H, and industry specific organizations. Second category created was media enveloping books on one's own, extension papers, magazines, television, radio, enewsletters, and websites and/or blogs. As stated previously, 69 respondents reported about personal source use with an average response rate of 3 (Sometimes) and standard deviation of 0.7. Another 69 respondents reported about media source use with an average response rate of 2 (Seldom) and standard deviation of 0.7.

Beef cattle knowledgeable respondents reported first-hand experience, family, and college courses as the most commonly used sources to acquire knowledge. Each held an average response rate of 4 (Often). Books on one's own, enewsletters, radio, and the 4-H organization were reported as the least commonly used sources. Each held an average response rate of 2 (Seldom). All other sources used held an average response rate of 3 (Sometimes). Dairy cattle knowledgeable respondents reported college courses as the most commonly used source with an average response rate of 4 (Often). Family was reported as the second most commonly used source with an average response rate of 3 (Sometimes). All other information sources used held an average response rate of 2 (Seldom). Hog and pig knowledgeable respondents reported college courses as the most commonly used source to acquire knowledge with an average response rate of 4 (Often). Respondents reported first-hand experience, family, and the FFA organization as the

second most used commonly used sources. Each held an average response rate of 3 (Sometimes). All other sources used were reported with an average response rate of 2 (Seldom). Poultry and egg knowledgeable respondents reported college courses as the most commonly used source with an average response rate of 4 (Often). First-hand experience and family were reported as the second most commonly used sources with each holding an average response rate of 3 (Sometimes). Enewsletters were reported as the least commonly used source with an average response rate of 1 (Never). All other sources used were reported with an average response rate of 2 (Seldom). Aquaculture knowledgeable respondents reported college courses as the most commonly used source with an average response rate of 3 (Sometimes). Radio was reported as the least commonly used source with an average response rate of 1 (Never). All other mediums were reported with an average response rate of 2 (Seldom). Sheep and goat knowledgeable respondents reported college courses as the most commonly used source with an average response rate of 4 (Often). First-hand experience, family, and the FFA organization were reported as the second most commonly used sources. Each held an average response rate of 3 (Sometimes). All other sources used were reported with an average response rate of 2 (Seldom). Other area knowledgeable respondents reported first-hand experience and college courses as the most commonly used sources with each holding an average response rate of 4 (Often). All other sources were split with either an average response rate of 3 (Sometimes) or 2 (Seldom). Produce crop knowledgeable respondents reported college courses as the most commonly used source with an average response rate of 4 (Often). First-hand experience and websites and/or blogs were

reported as the second most commonly used sources with each holding an average response rate of 3 (Sometimes). All other sources used were reported with an average response rate of 2 (Seldom). Greenhouse and nursery knowledgeable respondents reported sources with an average response rate of either 3 (Sometimes) or 2 (Seldom). Forestry knowledgeable respondents also reported sources with an average response rate of either 3 (Sometimes) or 2 (Seldom). Lastly, chemical, pesticide, and fertilizer knowledgeable respondents reported sources with an average response rate of either 3 (Sometimes) or 2 (Seldom). Only enewsletters were reported as the least commonly used source with an average response rate of 1 (Never).

For further summaries of data concerning Objective 2A and 2B see tables listed below. Table 5 is based on Group One and Two categorized information source use to acquire agricultural knowledge. Table 6 is based on Group One and Two overall averages of information source use.

Table 5

Group One and Two Categorized Information Source Use

	Categorized Information Source				
Group	Personal	Print	Digital	Broadcast	Media
One					
n	256	254	253	252	254
M	3	3	3	2	2
SD	0.7	0.8	0.9	0.7	0.7
α	.96	.96	.97	.97	.98
Two					
n	69	69	68	69	69
M	3	2	2	2	2
SD	0.7	0.7	0.7	0.8	0.7
α	.91	.53	.77	.98	.93

Note. Use Likert Scale numbers are as follows: 1 = Never. 2 = Seldom. 3 = Sometimes. 4 = Often. 5 = Almost Always.

Table 6

Group One and Two Information Source Use

	Information Source													
Area	Fh	Bo	Ep	Ma	Wb	En	Tv	Ra	Fa	Er	Cc	Fo	4h	Io
BECA														
One														
n	204	200	203	202	201	202	201	201	202	203	201	200	200	200
M	4	3	3	3	3	3	2	2	3	3	3	2	3	3
SD	1.1	1.1	1.1	1.0	1.0	1.1	0.9	0.9	1.3	1.1	1.4	1.3	1.3	1.2

Table 6 (continued)

	Information Source													
Area	Fh	Bo	Ep	Ma	Wb	En	Tv	Ra	Fa	Er	Cc	Fo	4h	Io
BECA														
Two														
n	60	59	58	58	59	58	59	58	59	57	60	59	59	59
M	4	3	2	3	3	2	3	2	4	3	4	3	2	3
SD	1.2	1.0	1.1	1.0	1.1	0.8	0.9	0.9	1.3	1.2	0.9	1.2	1.4	1.2
DACA														
One														
n	166	166	167	167	166	167	167	167	166	166	167	167	167	167
M	3	2	3	3	3	2	2	2	2	3	2	2	2	3
SD	1.2	1.2	1.2	1.1	1.1	1.1	0.9	0.8	1.2	1.2	1.3	1.1	1.0	1.2
Two														
n	48	47	47	47	47	46	47	47	47	45	48	47	47	47
M	2	2	2	2	2	2	2	2	3	2	4	2	2	2
SD	1.2	1.0	0.9	0.9	0.9	0.8	0.9	0.8	1.3	1.0	1.0	1.5	1.0	1.0
HOPI														
One														
n	157	155	158	158	157	157	156	156	157	155	157	156	157	157
M	3	2	3	3	3	2	2	2	3	3	3	2	2	3
SD	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Two														
n	44	44	44	44	44	44	44	44	43	44	45	42	44	44
M	3	2	2	2	2	2	2	2	3	2	4	3	2	2
SD	1.4	1.0	1.0	1.0	1.0	0.8	1.0	0.8	1.3	1.0	1.0	1.5	1.5	1.2

Table 6 (continued)

	Information Source													
Area	Fh	Bo	Ep	Ma	Wb	En	Tv	Ra	Fa	Er	Cc	Fo	4h	Io
POEG														
One														
n	155	155	156	155	155	156	154	154	154	154	153	153	154	154
M	3	2	3	2	3	2	2	2	2	3	2	2	2	2
SD	1.2	1.1	1.2	1.0	1.1	1.1	0.9	0.8	1.3	1.3	1.3	1.1	1.1	1.3
Two														
n	44	44	43	44	44	43	43	43	44	41	44	42	43	43
M	3	2	2	2	2	1	2	2	3	2	4	2	2	2
SD	1.4	1.0	0.8	0.9	1.0	0.8	1.0	0.9	1.3	1.1	1.2	1.5	1.2	0.9
AQUA														
One														
n	98	98	98	98	97	97	97	97	97	98	97	96	97	98
M	2	2	3	2	3	2	2	2	2	3	2	2	1	2
SD	1.2	1.2	1.3	1.1	1.1	1.0	0.9	0.8	0.9	1.3	1.3	1.0	0.9	1.3
Two														
n	6	6	6	6	6	6	6	6	6	6	6	6	6	6
M	2	2	2	2	2	2	2	1	2	2	3	2	2	2
SD	1.5	1.3	0.5	1.0	1.5	0.5	0.8	0.5	1.5	1.2	1.7	1.6	0.8	0.8
SHGO														
One														
n	145	145	145	145	145	145	145	145	146	144	145	146	144	146
M	3	3	3	3	3	2	2	2	2	3	3	2	2	2
SD	1.3	1.2	1.2	1.2	1.2	1.1	0.9	0.8	1.3	1.3	1.3	1.2	1.3	1.3
Two														
n	38	37	37	37	37	36	37	37	37	37	38	37	37	37
M	3	2	2	2	2	2	2	2	3	2	4	3	2	2
SD	1.3	1.3	1.1	1.2	1.2	1.0	1.0	0.9	1.4	1.3	1.2	1.7	1.5	1.2

Table 6 (continued)

	Information Source													
Area	Fh	Bo	Ep	Ma	Wb	En	Tv	Ra	Fa	Er	Cc	Fo	4h	Io
OTHR														
One														
n	138	137	137	137	137	137	137	137	139	138	139	137	136	138
M	4	3	3	3	3	2	2	2	3	3	3	2	2	3
SD	1.2	1.3	1.2	1.2	1.2	1.2	1.0	0.9	1.4	1.3	1.4	1.2	1.3	1.4
Two														
n	38	37	37	37	37	36	37	37	37	37	37	37	37	37
M	4	3	2	3	3	2	3	2	3	2	4	2	2	3
SD	1.1	1.4	1.2	1.3	1.1	1.1	1.1	1.0	1.4	1.2	1.3	1.5	1.6	1.6
PRCR														
One														
n	181	179	181	180	178	180	179	178	179	182	182	178	178	180
M	4	3	3	3	3	3	2	2	3	3	3	2	2	3
SD	1.1	1.3	1.3	1.2	1.2	1.3	0.9	1.0	1.5	1.3	1.5	1.0	1.0	2.0
Two														
n	31	30	31	31	31	31	31	31	31	30	31	31	31	31
M	3	2	2	2	3	2	2	2	2	2	4	2	2	2
SD	1.4	1.2	0.9	1.0	1.0	0.8	1.0	0.8	1.6	1.3	1.3	1.4	1.0	1.0
GHNU														
One														
n	154	154	153	153	151	154	150	150	150	153	152	150	149	153
M	4	3	3	3	3	2	2	2	2	3	3	2	2	3
SD	1.2	1.3	1.3	1.2	1.2	1.2	1.0	0.9	1.2	1.4	1.4	1.0	0.9	1.3
Two														
n	14	14	14	14	14	13	14	14	13	14	14	14	14	14
M	3	3	2	2	3	2	2	2	3	3	3	2	2	2
SD	1.2	1.1	1.1	1.0	0.8	0.6	1.0	0.7	1.5	0.9	1.1	1.4	1.3	0.9

Table 6 (continued)

	Information Source													
Area	Fh	Bo	Ep	Ma	Wb	En	Tv	Ra	Fa	Er	Cc	Fo	4h	Io
FORE														
One														
n	100	99	101	100	100	100	98	98	99	100	100	99	99	101
M	3	3	3	2	3	2	2	2	2	3	3	2	2	3
SD	1.2	1.3	1.2	1.1	1.2	1.1	0.9	0.8	1.0	1.4	1.3	1.0	0.8	1.4
Two														
n	15	15	15	15	15	15	15	15	15	15	15	15	15	15
M	3	2	2	2	2	2	2	2	3	2	4	2	2	2
SD	1.4	1.0	0.8	0.8	1.0	0.6	0.8	0.7	1.4	1.1	1.1	1.5	1.0	0.8
CHPF														
One														
n	186	182	185	184	183	184	183	182	183	187	184	181	181	185
M	4	3	3	3	3	2	2	2	2	3	3	1	1	3
SD	1.2	1.4	1.4	1.3	1.3	1.2	1.0	0.9	1.4	1.4	1.4	0.8	0.9	1.4
Two														
n	31	31	31	31	30	31	31	31	31	31	31	31	31	31
M	3	2	2	2	2	1	2	2	3	2	3	2	2	2
SD	1.4	1.1	0.8	0.9	1.1	0.6	0.9	0.9	1.4	1.2	1.3	1.0	0.8	1.0

Note. Group One α = .98. Group Two α = .90. Note. Area = Agriculture Subareas. Note. Fh = Firsthand Experience. Bo = Books on their Own. Ep = Extension Papers. Ma = Magazines. Wb = Websites/Blogs. En = Enewsletters. Tv = Television. Ra = Radio. Fa = Family. Er = Extension Personnel. Cc = College Courses. Fo= FFA Organization. 4h = 4-H Organization. Io = Industry Specific Organizations. Note. Use Likert Scale numbers are as follows: 1 = Never. 2 = Seldom. 3 = Sometimes. 4 = Often. 5 = Almost Always.

Objective 2C compared Group One and Two information source use through independent samples t-test. Comparing Group One and Two personal source use resulted in a t-value of -1 and a two-tailed significance of 0.36. Comparison of digital source use resulted in a t-value of 4 and a two-tailed significance of 0.00. Broadcast source use comparison resulted in a t-value of -1 and a two-tailed significance of -0.04. Print source use comparison resulted in a t-value of 6 and a two-tailed significance of 0.60. Lastly, media source use comparison resulted in a t-value of 4 and a two-tailed significance of 0.00. See Table 7 for a complete summary of data in regards to sample t-test comparison of Group One and Two categorized information source use.

Table 7

Comparison of Group One and Two Categorized Information Source Use

	Group One (N = *318*)		Group Two (N = *106*)					
Source	*M*	*SD*	*M*	*SD*	*df*	*t*	*P*	*α*
Personal	3	0.7	3	0.7	101	-1	0.36	.96
Digital	3	0.9	2	0.7	125	4	0.00	.96
Broadcast	2	0.7	2	0.7	108	-1	-0.04	.96
Print	3	0.8	2	0.8	116	6	0.60	.97
Media	2	0.7	2	0.7	116	4	0.00	.98

Note. Use Likert Scale numbers are as follows: 1 = Never. 2 = Seldom. 3 = Sometimes. 4 = Often. 5 = Almost Always. Note. T-values rounded to whole number.

4.2.3 Findings Related to Objective 3

Objective 3 aimed to identify adoption attitude towards using an information source to acquire agricultural information. Six, seven-point semantic differential scales were used for measurement. Attitude measurement was then divided into three main categories: significant, engagement and desirability. First category, significant, grouped the seven-point scales important (1) to unimportant (7) and relevant (1) to irrelevant (7). Second category, engagement, grouped exciting (1) to unexciting (7) and appealing (1) to unappealing (7). Lastly, third category, desirability, grouped worthless (1) to valuable (7) and not needed (1) to needed (7). The last two semantic differential scales were reversed to ensure individuals true attention to questions. Individuals also describe their monthly visitation (utilization) of sources to acquire agricultural information. Four categories for monthly visitation were developed. The four categories are as follows: digital, print, broadcast, and personal. Digital combined enewsletters and websites and/or blogs. Print combined books on one's own, extension papers, and magazines. Broadcast combined television and radio and lastly, personal combined extension personnel, family, and industry specific organizations. Along with monthly visitation, respondents described source form found to be pleasing for obtaining agricultural information. Four categories were created to describe source forms found to be pleasing to obtain agricultural information. Four categories created were digital, print, broadcast, and personal. Digital combined newsletters and websites and/or blogs. Print combined books on one's own, extension papers, and magazines. Broadcast combined television

and radio and lastly, personal combined extension personnel, family, and industry specific organizations. Personal for both monthly visitation and source forms found to be more pleasing were both missing first-hand experience, the FFA organization, the 4-H organization, and college courses. Both monthly source visitations and source preference questions combined print, digital, and broadcast to form the media category.

Objective 3A identified adoption attitude of respondents from Group One. Respondents ranked their belief about using a new source for gathering agricultural information on the overall semantic differential scale category of significant. A total of 239 respondents ranked their significant belief with an average belief scale response of 2 (Significant) was reported and standard deviation of 0.8. A total of 239 respondents ranked their belief about using a new source on the overall semantic differential scale category of engagement belief. An average belief scale response of 2 (Engaging) was reported with a standard deviation of 1.2. Lastly, a total of 238 respondents ranked their belief about using a new source on the overall semantic differential scale category of desirability belief. An average desirability belief scale response of 6 (Desirable) was reported with a standard deviation of 1.0. As stated before, desirability scale was reversed to ensure respondent attention.

Respondents reported about their source monthly visitation. Of the 251 digital monthly visitation responses collected, an average of 3 (Sometimes) was reported with a standard deviation of 1.1. 247 respondents reported about their monthly print visitation with an average of 3 (Sometimes) and a standard deviation of 1.0. 246 responses with an average response of 2 (Once or Twice) were reported for monthly broadcast visitation

with a standard deviation 0.8. 248 monthly personal visitation respondents reported an average of 3 (Sometimes) with a standard deviation of 1.0. Lastly, 244 respondents reported about monthly media visitation with an average of 2 (Once or Twice and standard deviation of 0.8.

Respondents also reported about source form preferences when obtaining agricultural information. 248 digital source preference respondents reported an average of 3 (Sometimes) with a standard deviation of 0.9. 244 respondents reported print source preference with an average of 3 (Sometimes) and standard deviation of 0.8. 243 broadcast preference respondents reported an average of 2 (Seldom) with a standard deviation of 0.9. 244 personal source preference respondents reported an average of 3 (Sometimes) with a standard deviation of 1.0. Lastly, 241 respondents reported about media source preference with an average of 3 (Sometimes) and standard deviation of 0.7.

Objective 3B aimed to identify adoption attitude of Group Two. Just as in Group One, Group Two respondents were asked to rank their beliefs on seven point semantic differential scales about using a new source for gathering agricultural information. First respondents ranked their belief on the overall semantic differential scale category of significant. A total of 95 respondents ranked their significant belief with an average belief scale response of 2 (Significant) and standard deviation of 1.1. A total of 94 respondents ranked their belief about using a new source on the overall semantic differential scale category of engagement belief. An average belief scale response of 2 (Engaging) was reported with a standard deviation of 1.3. Lastly, a total of 95 respondents ranked their belief about using a new source on the overall semantic

differential scale category of desirability belief. An average desirability belief scale response of 6 (Desirable) was reported with a standard deviation of 1.4. As stated before, desirability belief scale was reversed to ensure respondent attention.

A total of 95 respondents reported about their monthly digital visitations. Of the responses, an average of 2 (Once or Twice) was reported with a standard deviation of 0.9. A total of 93 respondents reported about their monthly print visitation with an average response of 2 (Once or Twice) and standard deviation of 0.9. Along with these results, 93 respondents reported about monthly broadcast visitations with an average response of 2 (Once or Twice) and standard deviation of 0.9. Another 93 respondents reported about monthly personal visitations with an average response of 2 (Once or Twice) and standard deviation of 1.1. Lastly, 93 respondents reported about monthly media visitations with an average response of 2 (Once or Twice and standard deviation of 0.8.

Respondents also reported about source form preference. 95 respondents reported about digital source preference with an average response of 2 (Seldom) and standard deviation of 0.9. 93 respondents reported about print source preference with an average response of 2 (Seldom) and standard deviation of 0.9. 63 respondents reported about broadcast source preference with an average response of 2 (Seldom) and standard deviation of 0.9. 93 respondents reported about personal source preference with an average response of 2 (Seldom) and standard deviation of 1.1. A final response of 89 respondents reported about media source preference with an average response of 3 (Sometimes) and standard deviation of 0.7.

For further summaries of data concerning Objective 3A and 3B see tables listed below. Table 8 is based on Group One and Two categorized attitude beliefs. Table 9 is based on Group One and Two monthly categorized information source visitations. Table 10 is based on Group One and Two categorized information source form preference.

Table 8

Group One and Two Categorized Attitude Beliefs

	Categorized Attitude Belief		
Group	Significant	Engagement	Desirability
One			
n	239	239	238
M	2	2	6
SD	0.8	1.2	1.0
α	.89	.88	.88
Two			
n	95	94	95
M	2	2	6
SD	1.1	1.3	1.4
α	.96	.91	.92

Note. Categorized Attitude Beliefs are as follows: Significant = (Important to Unimportant) + (Relevant to Irrelevant). Engagement = (Exciting to Unexciting) + (Appealing to Unappealing). Desirability = (Worthless to Valuable) + (Not Needed to Needed). Note. All Seven Point Semantic Differential Scales use the following scaling: 1 (Positive) to 7 (Negative). Desirability Belief is reversed.

Table 9

Group One and Two Monthly Categorized Information Source Visitations

	Categorized Information Source				
Group	Personal	Print	Digital	Broadcast	Media
One					
n	248	247	251	246	244
M	3	3	3	2	2
SD	1.0	1.0	1.1	0.8	0.8
α	.54	.76	.72	.72	.82
Two					
n	93	93	95	93	93
M	2	2	2	2	2
SD	1.1	0.9	0.9	0.9	0.8
α	.77	.72	.71	.80	.86

Note. Visitation Likert Scale numbers are as follows: 1 = Never. 2 = Once or Twice. 3 = Sometimes. 4 = Regularly. 5 = Very Often.

Table 10

Group One and Two Categorized Information Source Form Preferences

	Categorized Information Source				
Group	Personal	Print	Digital	Broadcast	Media
One					
n	244	244	248	243	241
M	3	3	3	2	3
SD	1.0	0.8	0.9	0.9	0.7

Table 10 (continued)

Group	Categorized Information Source				
	Personal	Print	Digital	Broadcast	Media
One					
α	.54	.59	.62	.78	.70
Two					
n	93	93	95	63	89
M	2	2	2	2	3
SD	1.1	0.9	0.9	0.9	0.7
α	.69	.61	.55	.46	.71

Note. Preference Likert Scale numbers are as follows: 1 = Never. 2 = Seldom. 3 = Sometimes. 4 = Often. 5 = Almost Always.

Objective 3C aimed to identify adoption attitudes through sample t-test comparison of Group One and Two. In comparing Group One and Group Two attitude beliefs, significant belief when compared through an independent sample t-test resulted in a t-value of -1 and a two-tailed significance value of 0.19. Comparison of engagement belief resulted in a t-value of 0 and a two-tailed significance value of 0.93. Lastly, comparison of desirability belief resulted in a t-value of 1 and a two-tailed significance value of 0.34.

In comparing Group One and Group Two monthly source visitations to obtain agricultural information through a samples independent t-test, comparison of monthly personal visitation resulted in a t-value of 3 and a two-tailed significance value of 0.00. Comparison of monthly print visitation resulted in a t-value of 0.9 and a two-tailed

significance value of 0.00. Comparison of monthly digital visitation resulted in a t-value of 6 and a two-tailed significance value of 0.00. Comparison of monthly broadcast visitation resulted in a t-value of -2 and a two-tailed significance value of 0.04. Lastly, comparison of monthly media visitations resulted in a t-value of 4 and a two-tailed significance value of 0.00.

Also, Group One and Group Two source preferences were compared using an independent samples t-test. Comparison of personal preference resulted in a t-value of 3 and a two-tailed significance value of 0.01. Comparison of print preferences resulted in a t-value of 7 and a two-tailed significance value of 0.00. Comparison of broadcast preferences resulted in a t-value of 6 and a two-tailed significance value of 0.07. Comparison of personal preferences resulted in a t-value of 3 and a two-tailed significance value of 0.00. Lastly, comparison of media preferences resulted in a t-value of 1 and a two-tailed significance value of 0.26. See tables listed below for a summary of data regarding Group One and Two's t-test comparisons for categorized attitude beliefs (Table 11), monthly categorized information source visitations (Table 12), and categorized information source form preferences (Table 13).

Table 11

Comparison of Group One and Two Categorized Attitude Beliefs

	Group One (N = *318*)		Group Two (N = *106*)					
Source	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	*α*
Significant	2	0.8	2	1.1	137	-1	0.19	.92
Engagement	2	1.2	2	1.3	158	0	0.93	.89
Desirability	6	1.0	6	1.4	138	1	0.34	.90

Note. Categorized Attitude Beliefs are as follows: Significant = (Important to Unimportant) + (Relevant to Irrelevant). Engagement = (Exciting to Unexciting) + (Appealing to Unappealing). Desirability = (Worthless to Valuable) + (Not Needed to Needed). Note. All Seven Point Semantic Differential Scales use the following scaling: 1 (Positive) to 7 (Negative). Desirability Belief is reversed. Note. T-values rounded to whole number.

Table 12

Comparison of Group One and Two Monthly Categorized Information Source Visitations

	Group One (N = *318*)		Group Two (N = *106*)					
Source	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	*α*
Personal	3	1.0	2	1.1	157	3	0.00	.60
Print	3	1.0	2	0.9	189	7	0.00	.77
Digital	3	1.1	2	0.9	199	6	0.00	.75
Broadcast	2	0.8	2	0.9	154	-2	0.04	.74
Media	2	0.8	2	0.8	170	4	0.00	.83

Note. Visitation Likert Scale numbers are as follows: 1 = Never. 2 = Once or Twice. 3 = Sometimes. 4 = Regularly. 5 = Very Often. Note. T-values rounded to whole number.

Table 13

Comparison of Group One and Two Categorized Information Source Form Preferences

	Group One (N = *318*)		Group Two (N = *106*)					
Source	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	*α*
Personal	3	1.0	2	1.1	149	3	0.01	.56
Print	3	0.8	2	0.9	159	4	0.00	.59
Digital	3	0.9	2	0.9	148	2	0.07	.59
Broadcast	2	0.9	2	0.9	158	-5	0.00	.70
Media	3	0.7	3	0.7	149	1	0.26	.68

Note. Preference Likert Scale numbers are as follows: 1 = Never. 2 = Seldom. 3 = Sometimes. 4 = Often. 5 = Almost Always. Note. T-values rounded to whole number.

4.2.4 Findings Related to Objective 4

Objective 4 compared Group One and Two overall adoption attitudes towards using an online informational resource. Both group respondents were provided a post survey to report their overall adoption attitude towards using an online informational resource. Post surveys contained questions based on confidence in understanding subject matter, comfortableness in describing subject matter, and overall likes and/or dislikes of online information source. Combined questions formed an overall adoption attitude.

A total of 58 respondents from Group One reported about their overall adoption attitude with an average response rate of 4 (Positive) and standard deviation of 0.6. 92 respondents from Group Two reported about their adoption attitude with an average

response of 4 (Positive) and standard deviation of 0.5. In comparing Group One and Group Two responses about their overall adoption attitude an independent t-test resulted in a t-value of -2 and a two-tailed significant value of 0.03. See Tables 14 and 15 for summary of data regarding combined groups' overall adoption attitudes towards using an online informational resource.

Table 14

Group One and Two Overall Adoption Attitudes

Group	Overall Adoption Attitude
One	
n	58
M	4
SD	0.6
α	.86
Two	
n	92
M	4
SD	0.5
α	.81

Note. Multiple Likert Scales used. Note. T-values rounded to whole number.

Table 15

Comparison of Group One and Two Overall Adoption Attitudes

	Group One (N = *318*)		Group Two (N = *106*)					
Attitude	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	*α*
Adoption	4	0.6	4	0.5	111	-2	0.03	.84

Note. Multiple Likert Scales used. Note. T-values rounded to whole number.

CHAPTER V

CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

5.1 Introduction

Understanding where agricultural leaders/specialists (knowledgeable individuals from Group One) and consumers (Group Two) are receiving their agricultural information plays an important role in allowing individuals to provide information in a future effective manner. This study aimed to help in understanding a most affective source of information delivery so as to find a common, better mean to provide and acquire agricultural information. This chapter begins with a review of the problem statement and purpose that were used as a research guide. After reviewing, conclusions, recommendations, and implications are discussed based on research findings. Last section of chapter is directed towards discussion of research.

Purpose of study was to determine where agricultural information is acquired by individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments and adoption attitude towards utilizing a new media form to acquire agricultural information.

5.2 Objectives

1. Identify agricultural knowledge levels.
2. Identify commonly used information sources for agricultural knowledge acquisition.
3. Identify adoption attitude towards using an information source to acquire agricultural information.
4. Compare individuals', in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments, adoption attitudes towards using an online informational source.

5.3 Conclusions, Recommendations, and Implications

Research evaluated several quantitative questions that sought to identify knowledge levels compared to non-agriculturally minded consumers, commonly used information sources for knowledge acquisition, engagement with agricultural events, and new source adoption characteristics. Research questions addressed through qualitative methods focused on individual's use of an online information source. A descriptive, convergent parallel mixed-methods design was employed to identify self-reported, commonly used information sources used to acquire data about production agriculture.

Study limitations from both Group One and Two resulted in weak data. Sufficient power must be present during analysis for any statistical significance to exist.

Due to the overall population's low response rate, insufficient statistical power was present. In turn, this did not allow a means to draw any substantive conclusions. From the little data acquired, however, some insight and a starting point for further studies concerned with common agricultural information sources was found. Overall, this data is anecdotal and no significant conclusions were drawn from analysis.

5.3.1 Objective 1

Group One and Two respondent knowledge levels were compared in respect to an overall average of response averages acquired about agricultural areas and subareas. Group One respondents were observed having an average area and subarea knowledge level of 4 (Higher, $M = 3.6$). Group Two respondents were observed having a comparable area and subarea knowledge level average of 4 (Higher).

Reason for these results could be due to a higher number of respondents from Group One ($n = 318$) than in Group Two ($n = 106$). Personal and professional characteristics from Group One and Group Two may have also played a role in overall understanding of an area or subarea. Also, environment at time of survey completion may have affected outcome of individuals' ability to report knowledge levels. Individuals in Group One were allowed to take surveys at their convenience in the location of their choosing. Individuals in Group Two, however, were only allowed to take surveys at certain locations on the Texas A&M University campus during set time slots. All of these may have influenced reporting about one's self.

5.3.2 Objective 2

Group One and Two respondents reported about their use of information sources to acquire agricultural information. Group One respondents were observed having an overall average use response rate of 3 (Sometimes, $M = 2.6$) in concern to using provided information sources to obtain agricultural information. Group Two respondents were observed having an overall average use response rate of 2 (Seldom, $M = 2.2$) in concern to using provided information sources to obtain agricultural information. With these results, it can be determined that Group One utilized provided information sources more than Group Two. Main difference in response averages seen was Group One's higher use of digital and print sources than Group Two's. These sources were observed having an average use response of 3 (Sometimes) for Group One and only an average use response of 2 (Seldom) for Group Two. Results overall may be due to Group One possibly having a higher interest or need for up-to-date information than Group Two. Group Two's equal average use response of 3 (Sometimes) for personal sources may be due to respondents' employment status as a student still taking collegiate courses.

Print, digital, and broadcast sources were combined to form a media category used for comparison between Group One and Two. Group One responses about using media to obtain agricultural information were equal to Group Two with each holding an average use response of 2 (Seldom).

Lastly, independent-samples t-tests were conducted to compare Group One and Two information source use. Results showed there was not a significant difference in

personal source use responses for Group One (M = 3, SD = 0.7) and Group Two (M = 3, SD = 0.7) conditions; t(101) = -1, p = 0.36. A significant difference existed in digital source use responses for Group One (M = 3, SD = 0.9) and Group Two (M = 2, SD = 0.7) conditions; t(125) = 4, p = 0.00. A significant difference also existed in broadcast source use responses for Group One (M = 2, SD = 0.7) and Group Two (M = 2, SD = 0.7) conditions; t(108) = -1, p = -0.04. There was not a significant difference in print source use responses for Group One (M = 3, SD = 0.8) and Group Two (M = 2, SD = 0.8) conditions; t(116) = 6, p = 0.60. Lastly, an independent-samples t-test was conducted to compare media source use in Groups One and Two. A significant difference existed in media source use responses for Group One (M = 2, SD = 0.7) and Group Two (M = 2, SD = 0.7) conditions; t(116) = 4, p = 0.00. Overall, results for Group One and Two remained between the use responses of 2 (Seldom) and 3 (Sometimes). Even though responses were similar between the two groups, seldom (2) and sometimes (3) are representative of inconsistent use. Thus, a conclusion cannot be drawn towards any one common information source.

5.3.3 Objective 3

Adoption attitude was reported for both Groups One and Two in terms of using an information source to acquire agricultural information. Group One responses (M = 2, SD = 0.8) about having an attitude of significant belief towards using a new source to acquire agricultural information were roughly the same as Group Two (M = 2, SD = 1.1).

Group One responses ($M = 2$, $SD = 1.2$) about having an attitude of desirability belief towards using a new source were also roughly the same as Group Two ($M = 2$, $SD = 1.3$). Lastly, Group One responses ($M = 6$, $SD = 1.0$) about having an attitude of engagement belief towards using a new source were roughly the same as Group Two ($M = 6$, $SD = 1.4$).

An independent samples t-test was conducted to compare attitude of significance belief between Group One and Two. There was not a significant difference in significant belief responses for Group One ($M = 2$, $SD = 0.8$) and Group Two ($M = 2$, $SD = 1.1$) conditions; $t(137) = -1$, $p = 0.19$. An independent samples t-test was also conducted to compare attitude of engagement belief between Group One and Two. Again there was not a significant difference in engagement belief responses for Group One ($M = 2$, $SD = 1.2$) and Group Two ($M = 2$, $SD = 1.3$) conditions; $t(158) = 0$, $p = 0.93$. Lastly, an independent samples t-test was conducted to compare Group One and Two attitude of desirability belief. Again, no significant difference existed in desirability belief responses for Group One ($M = 6$, $SD = 1.0$) and Group Two ($M = 6$, $SD = 1.4$) conditions; $t(138) = 1$, $p = 0.34$.

Overall adoption attitude for Group One and Two also included monthly source visitations to acquire agricultural information. An independent samples t-test was conducted to compare Group One and Two monthly categorized information source visitations. There was a significant difference in the monthly personal source visitation responses for Group One ($M = 3$, $SD = 1.0$) and Group Two ($M = 2$, $SD = 1.1$) conditions; $t(157) = 3$, $p = 0.00$. A significant difference existed in monthly print source

visitation responses for Group One (M = 3, SD = 1.0) and Group Two (M = 2, SD = 0.9) conditions; $t(189) = 7$, $p = 0.00$. Significant difference existed in monthly digital source visitation responses for Group One (M = 3, SD = 1.1) and Group Two (M = 2, SD = 0.9) conditions; $t(199) = 6$, $p = 0.04$. Significant difference also existed in monthly broadcast source visitation responses for Group One (M = 2, SD = 0.8) and Group Two (M = 2, SD = 0.9) conditions; $t(154) = -2$, $p = 0.00$. Lastly, overall adoption attitude combined monthly print, broadcast, and digital source visitations to form a monthly media source visitation category. Significant difference existed in monthly media source visitation responses for Group One (M = 2, SD = 0.8) and Group Two (M = 2, SD = 0.8) conditions; $t(170) = 4$, $p = 0.00$.

Overall adoption attitude also included Group One and Two categorized information source form preferences to obtain agricultural information. An independent samples t-test was conducted to compare Group One and Two preferences. No significant difference existed in digital source preference responses for Group One (M = 3, SD = 0.9) and Group Two (M = 2, SD = 0.9) conditions; $t(148) = 2$, $p = 0.07$. A significant difference in print source preference responses for Group One (M = 3, SD = 0.9) and Group Two (M = 2, SD = 0.9) conditions; $t(158) = 4$, $p = 0.000$. A significant difference existed in personal source preference responses for Group One (M = 3, SD = 1.0) and Group Two (M = 2, SD = 1.1) conditions; $t(149) = 3$, $p = 0.01$. A significant difference also existed in broadcast source preference responses for Group One (M = 2, SD = 0.9) and Group Two (M = 2, SD = 0.9) conditions; $t(158) = -5$, $p = 0.00$. Lastly, overall adoption attitude combined print, broadcast, and digital forms to make a media

form. No significant difference existed media source preference responses for Group One ($M = 3$, $SD = 0.7$) and Group Two ($M = 3$, $SD = 0.7$) conditions; $t(149) = 1$, $p = 0.26$.

In combining attitude belief, new source use, and source form preference, it was observed that Group One held a higher (more positive) adoption attitude. Overall adoption attitude could lead to a better understanding of where individuals acquire agricultural information by revealing diffusion of innovations or adopter style.

5.3.4 Objective 4

Lastly, Objective 4 compared Group One and Two responses about adoption attitudes towards using an online informational source. An independent samples t-test was used to compare these adoption attitudes. A significant difference existed in adoption attitude responses for Group One ($M = 4$, $SD = 0.6$) and Group Two ($M = 4$, $SD = 0.5$) conditions; $t(111) = -2$, $p = 0.03$. Results suggest that Group Two respondents held a slightly higher (more positive reaction/perception) attitude towards using an online informational source than Group Two. Adopter style and diffusion of an innovation applies the same here as it did for an overall adoption attitude for Objective 3, along with individual retention and source form engagement. In turn, providing a means to discovering a more solid common information source.

5.4 Additional Discussion and Final Summary

In conclusion, this study aimed to determine where agricultural data is acquired by individuals in an agriculturally-related occupation in Texas and individuals 18 years of age or older involved with or within Texas agricultural higher education or extension environments and adoption attitude towards utilizing a new source form to acquire agricultural data.

Overall findings of this study suggest there is truly no difference between Group One and Two respondents in how and where they acquire agricultural information. However, even though these groups' acquisitions were not different, the results do not show a real direction to any one source of commonality. Differences discovered turned out to be smaller than initially thought would occur. The same applied to the research findings and added to the problem of trying to find a common information source.

Result may be due to lack of respondents that took time to take the survey and/or complete it. Also, questions may not have been accurately written and thus answers provided were not true reflections of an individual's perceived response. Further assessment of the surveys' questions should be done to ensure proper reporting. Another area to reassess was completion of provided post survey. A low number of respondents from Group One responded to the post survey, which could have been due to website layout.

Also a continued growth in the body of literature could be reviewed in more depth during another study course. New studies and research are being done to further

asses the use of Internet, digital mediums and ways to acquire and provide information. Along with this, agricultural information is being produced with more defining factors to be addressed or measured. Also with growing information in these areas, careful evaluation of ethics, values and standards should be addressed for future research in the area of agricultural information. With ethical observations, further research should be observed in psychological effects of using digital or new technology sources to acquire agricultural information.

One area of the study that was a limitation was the website provided as a new technology source to provide agricultural information. The website only provided information about beef cattle due to compartmentalizing in a way like the overall agricultural industry. Also, the website could only provide one area of study due to length and time constraints. Due to using only one area, individuals may have been discouraged to review it and further progress to the post survey causing even lower data results. More areas of agriculture should be provided in further research studies.

Learners or respondents' innovation levels would also be an area to research for further understanding adoption and attitude of new technology. Style of learning and whether or not an individual is creative, artistic, or not, could play into effect how well individuals could perceive themselves using a new technology information source. This may also affect how information delivery is either accepted or denied by individuals. However, self-identified attributes by individuals may be corrupted or less valuable due to influence from an outside environment. This could also be a part of individuals'

behavior which should be observed more in depth on how individuals adopt or utilize information.

Somewhat strong attributes of positivity and negativity were found in this study towards the four main broad sources: personal, print, digital, and broadcast. These attitude attributes may be useful to further exploring provision of agricultural information to both consumers and specialists. However, these attitude attributes were limited due to the overall scope of the study observing multiple means to acquiring, providing, and using information. Another manner of limitation came from using a convenience sample in one setting. The study may have acquired new attitudes and differing results from a larger study sample and a more narrowed observation goal. A more focused research that specified exact and narrowed attributes could have been a better means to providing more precise data about information source commonality.

Another area is that of technology trends and applications that evolve to bring about more manners and means of providing information. With new platforms and formats being created, further research should incorporate these new evolutions, which may in turn expand on individuals' choice. There are many factors missing from this research study, but as a starting point it should lay groundwork out for how to progress on to other studies. As complexity in the agricultural and technology sectors grow, more evidence will be required to make further conclusions.

In addition to revealing the use of sources to obtain agricultural information and adoption attitude, this study served as a step for developing a means to create informational sources to provide agricultural information from producers to consumers.

Using this study as a guide, individuals can implement a more unified means of presenting and providing agricultural information. By studying the main utilized mediums used by these two major groups and applying the results found, agricultural information can find a more unified and improved method for traversing between different groups.

Also, individual's transparency in taking a survey ranging from anonymity to personal identifiers, should be further evaluated. By reviewing how individuals provide anonymity or transparency research can further see and correlate how individuals personalize themselves digitally or when using a new source to acquire agricultural information.

Research in the area of computer science, semantic web, and digital technologies used for providing agricultural information could be observed to further understand how sources affect individuals' mean for use. Along with this, pedagogical use with these mediums could also be observed or researched.

Analysis of all these areas may lead to further innovations and lead to using better sources for acquiring agricultural information. Attributes combined with these sources could be predictors for individuals' mannerisms and preferences. With this research, more advanced and easier innovations may be brought about to provide and obtain agricultural information. Alongside predictors, decisions for innovations and adoption or rejection of innovations could be observed providing more factors and attributes to understanding innovation use or acquisition of information. These may also

tie into professional and personal characteristics that determine how information sources will be used.

In conclusion, focusing on a more narrowed topic could result in a better understanding of where agricultural information is being acquired and which sources are more likely used. Findings from this study could not provide a solid answer to where agricultural information is acquired due to too low response rates and numerous study flaws. This study was meant to provide a starting point for developing a platform for producers and consumers to share agricultural information. Though this study did not succeed in its overall goals it still remains useful. The findings acquired about sources used for obtaining agricultural information may hold true in a larger study, along with provided background research that could help create a better understanding of the complex nature of agricultural information. Lastly, the methodology for more related research studies has been developed and established through this study. Overall, this study was only one brick to help build something better.

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APPENDIX A

CONTACT FORMS AND ANNOUNCEMENTS

A-1 Initial Email (Group One)

February 7, 2014
Dear Agriculturally Related Individual,

My name is Colton Atkins. I am a graduate student in Agriculture Communications and Journalism at Texas A&M University. I am asking for your help on my thesis research about individuals' awareness of sources used to obtain agricultural information. This study is observing individuals in Texas in an agriculturally related occupation along with agricultural consumers. Since you are in an agriculturally related occupation, your thoughts and opinions would add tremendous value to the quality of this study.

In the next few days, you will receive an email asking you to interact with a website that is attached and to complete a questionnaire about your knowledge prior to using the website and a questionnaire over your experiences with the website. I am writing in advance, so you will be prepared for the arrival of the email with the pre-questionnaire and site link. Once you have completed the pre-questionnaire and reviewed the site you will be asked to take a post-questionnaire located on the site as a final part of this study. Your responses to these questionnaires will be analyzed.

The questionnaires should take approximately 15-30 minutes to answer. Your responses are voluntary and will be kept confidential. You must be 18 years of age or older. If you have any questions about this survey instrument, please contact me at 979-219-0551 or coltonatkins07@gmail.com. If you have any questions about your rights as a participant in the study, please contact the Human Subjects' Institutional Review Board at 979-458-4067.

Your expertise is very valuable to this study. Thank you in advance for taking time out of your schedule to complete the questionnaires. It is only with the generous help of people like you that this study will be a success.

Sincerely,
Colton A. Atkins
Agriculture Communications and Journalism Graduate Student

Department of Agricultural Leadership, Education and Communications
600 John Kimbrough Boulevard, 2116 TAMU, College Station, TX 77843-2116

Tel.: 979-219-0551 / Email: coltonatkins07@gmail.com

A-2 Follow-Up Email (Group Two)

February 12, 2014
Dear Agriculturally Related Individual,

Over the last couple of days you received an email with information pertaining to a study I am conducting at Texas A&M University, regarding research about individuals' awareness of sources used to obtain agricultural information by observing individuals in Texas in an agriculturally related occupation along with agricultural consumers. You were selected to help, due to the fact that you are in an agriculturally related occupation.

If you do not wish to partake or feel that you received this email by mistake, please ignore. If you did not receive the initial email and would like more information pertaining to this study, please contact me using the contact information at this end of this email. If you do wish to partake in this study, please find listed below a link to the questionnaires and website. The pre and post surveys and website review should take approximately 15 to 30 minutes. Once you submit an answer you may not change it. To view the website we suggest using an updated browser. Please note that the questionnaires and website will be active until February, 23 (Sunday).

Link to Questionnaires: **ARIEL SURVEY**

Your time is valuable, and I am very appreciative of your help in this research. If you have any questions or comments, please feel free to contact me at (979) 219-0551 or at coltonatkins07@gmail.com. Again, thank you in advance for taking time out of your schedule to complete the questionnaires. It is only with the generous help of people like you that this study will be a success.

Sincerely,
Colton A. Atkins
Agriculture Communications and Journalism Graduate Student

Department of Agricultural Leadership, Education and Communications
600 John Kimbrough Boulevard, 2116 TAMU
College Station, TX 77843-2116

Tel.: 979-219-0551
Email: coltonatkins07@gmail.com
Alt Email: coltonatkins07@tamu.edu

A-3 Class Announcement (Group Two)

Howdy!

My name is Colton Atkins and I am a master's student in Agriculture Communications and Journalism at Texas A&M University. I am asking for your help on my thesis about agricultural industry leader and consumer awareness of agriculture information. Since you are an agriculture student, your thoughts and opinions about the website, its content, and usability would add tremendous value to the quality of the research project.

During the next few days, I will be set up outside your classroom at an interaction station with computers for viewing a website based on agriculture information. If you choose to participate you will be asked to sign a consent form before your participation. Once signed you will complete a questionnaire about your knowledge prior to using the site and a questionnaire over your experiences with the website. Once you have completed the pre-questionnaire and reviewed the site you will be asked to take a post-questionnaire located on the site as a final part of this study. Your responses to these questionnaires will be analyzed. I am asking in advance, so you will have time to consider your participation.

The questions should take 15-30 minutes to answer. Your responses are voluntary and will be kept confidential. You must be 18 years of age or older. If you have any questions about this survey instrument, please contact me at 979-219-0551 or coltonatkins07@gmail.com. If you have any questions about your rights as a participant in the study, please contact the Human Subjects' Institutional Review Board at 979-458-4067.

Your participation is very valuable to us. Thank you in advance for taking time out of your schedule to be a part of this. It is only with the generous help of people like you that this study will be a success.

APPENDIX B

INFORMATION AND SIGNATURE FORMS (GROUP ONE AND TWO)

B-1 Group One Information Form (Attached to Email)

A.R.I.E.L. Study Information Form

Introduction:
You are being asked to participate in a research study to determine agriculture leader's and consumer's knowledge of agriculture information, the use of the Agricultural Resource Intelligent Educational Lecturer program, and retention of agriculture information after utilizing A.R.I.E.L. We are asking you to participate because you are a leader or professional in the agriculture industry.

Please read this form carefully, and ask any questions you may have before agreeing to take part in the study.

What the study is about:
The purpose of this study is to determine where individuals are gaining their agriculture information, their understanding of agriculture information presented in a new technological manner, and retention of agriculture information after use of a new technological manner.

What we will ask you to do:
If you agree to participate in this study, we will ask you to complete a pre-test, interact with the A.R.I.E.L. program and complete a post-test. The questionnaires will include questions about your knowledge of agriculture information, age, race, ethnicity, education, retention of agriculture knowledge presented, and suggestions for improving the presentation. The overall interaction and two questionnaires will take about 15 to 30 minutes to complete.

Risks and Benefits:
The potential risk for individuals associated with this study is a breach of confidentiality. The potential benefit associated with this study is for individuals to acquire a better understanding of where and how their food is produced.

Compensation:
There is no direct compensation for participating in this study.

Your answers will be confidential:
The records of this study will be kept private. In any sort of report we make public, we will not include any information that will make it possible to identify you. All data will be reported as group data. Research records will be kept in a locked file; only the researchers will have access to the records. All data will be kept for a minimum of three years in accordance with the IRB regulation after the study is completed.

Taking part is voluntary:
Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with this study. If you decide to take part, you are free to withdraw at any time. Please let the investigator know that you are withdrawing.

If you have questions about the study or your Rights as a Research Participant:
The researchers conducting this study are Colton Atkins, Teri Antilley, and Dr. Tracy Rutherford. Please ask any questions you have now. If you have questions later, you may contact Colton Atkins at coltonatkins07@gmail.com or at 979-219-0551. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at 979-458-4067 or access their website at http://rcb.tamu.edu/humansubjects. You may also report your concerns or complaints anonymously through Ethicspoint (https://secure.ethicspoint.com/domain/media/en/gui/20488/index.html) or by calling toll free at 1-866-297-0224. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

You may print a copy of this form to keep for your records.

Consent Form Life Span:
This consent form will be kept by the researcher for at least three years beyond the end of the study. Please note that by entering and completing the online surveys, you give permission to the researcher to use your responses for research purposes.

B-2 Group Two Information and Consent Form

A.R.I.E.L. Study Consent Form

Introduction:
You are being asked to participate in a research study to determine agriculture consumer's knowledge of agriculture information, the use of the Agricultural Resource Intelligent Educational Lecturer program, and retention of agriculture information after utilizing A.R.I.E.L. We are asking you to participate because you are a student at Texas A&M University with classes in the College of Agriculture and Life Sciences building or in the Kleberg building.

Please read this form carefully, and ask any questions you may have before agreeing to take part in the study.

What the study is about:
The purpose of this study is to determine where individuals are gaining their agriculture information, their understanding of agriculture information presented in a new technological manner, and retention of agriculture information after use of a new technological manner.

What we will ask you to do:
If you agree to participate in this study, we will ask you to complete a pre-test, interact with the A.R.I.E.L. program and complete a post-test. The questionnaires will include questions about your knowledge of agriculture information, age, race, ethnicity, education, retention of agriculture knowledge presented, and suggestions for improving the presentation. The overall interaction and two questionnaires will take about 15 to 30 minutes to complete. Please find that if you are a student, you must be 18 years of age or older to participate in this research study.

Risks and Benefits:
The potential risk for individuals associated with this study is a breach of confidentiality. The potential benefit associated with this study is for individuals to acquire a better understanding of where and how their food is produced.

Compensation:
There is no direct compensation for participating in this study, however, participants may earn extra academic credit, at the discretion of their professors.

Your answers will be confidential:
The records of this study will be kept private. In any sort of report we make public, we will not include any information that will make it possible to identify you. All data will

be reported as group data. Research records will be kept in a locked file; only the researchers will have access to the records. All data will be kept for a minimum of three years in accordance with the IRB regulation after the study is completed.

Taking part is voluntary:
Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with this study. If you decide to take part, you are free to withdraw at any time. Please let the investigator know that you are withdrawing.

If you have questions about the study or your Rights as a Research Participant:
The researchers conducting this study are Colton Atkins, Teri Antilley, and Dr. Tracy Rutherford. Please ask any questions you have now. If you have questions later, you may contact Colton Atkins at coltonatkins07@gmail.com or at 979-219-0551. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at 979-458-4067 or access their website at http://rcb.tamu.edu/humansubjects. You may also report your concerns or complaints anonymously through Ethicspoint (https://secure.ethicspoint.com/domain/media/en/gui/20488/index.html) or by calling toll free at 1-866-297-0224. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

You may print a copy of this form to keep for your records.

Consent Form Life Span:
This consent form will be kept by the researcher for at least three years beyond the end of the study.

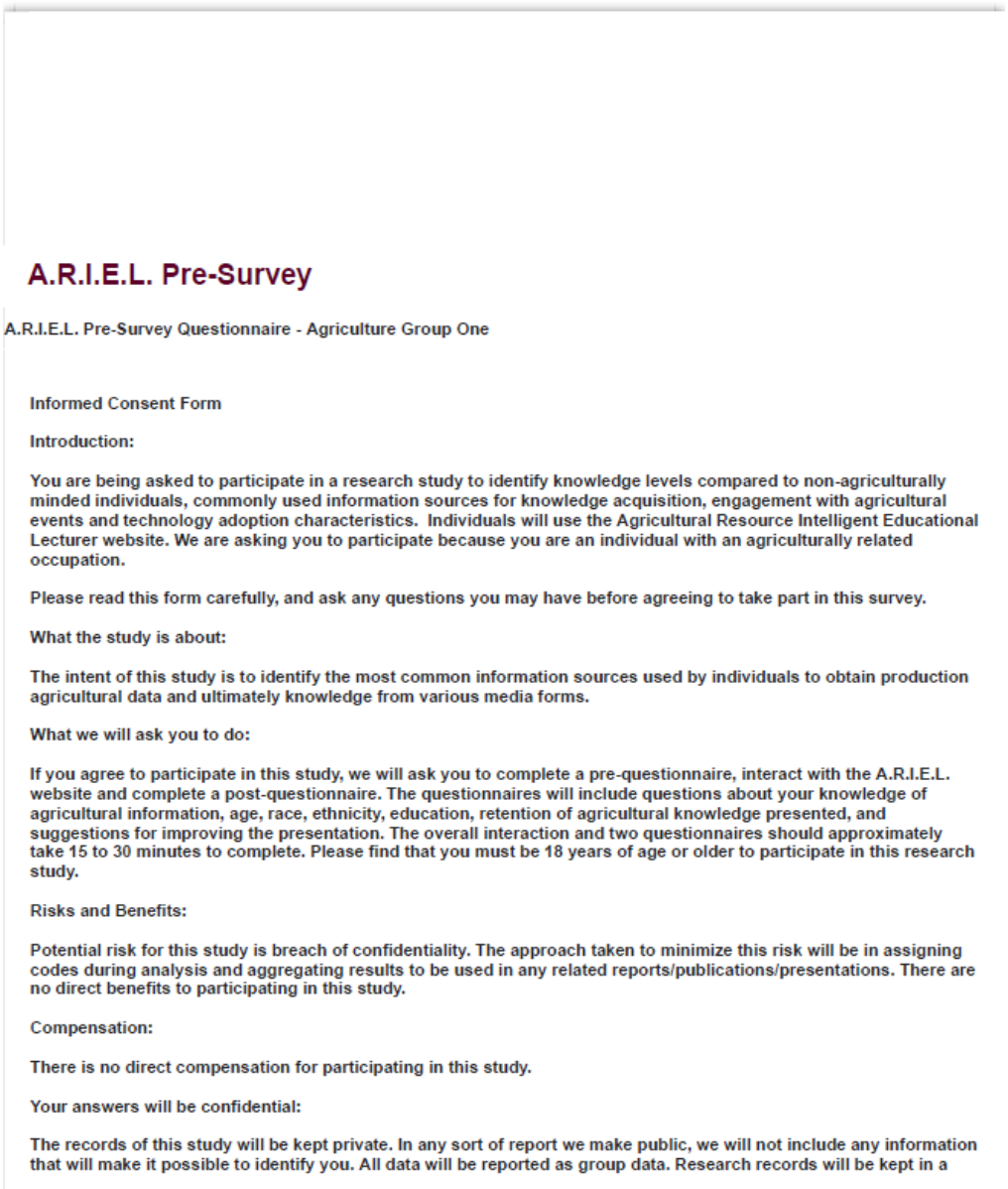
Statement of Consent:
I have read the above information, and have received answers to any questions I asked. I consent to take part in the study.

Your Signature _____ Date _____
Your Name (printed) _____
Signature of person obtaining consent _____ Date _____
Printed name of person obtaining consent _____
Date _____

APPENDIX C

GROUP ONE AND TWO SURVEYS (PRE AND POST)

C-1 Group One Pre-Survey



A.R.I.E.L. Pre-Survey

A.R.I.E.L. Pre-Survey Questionnaire - Agriculture Group One

Informed Consent Form

Introduction:

You are being asked to participate in a research study to identify knowledge levels compared to non-agriculturally minded individuals, commonly used information sources for knowledge acquisition, engagement with agricultural events and technology adoption characteristics. Individuals will use the Agricultural Resource Intelligent Educational Lecturer website. We are asking you to participate because you are an individual with an agriculturally related occupation.

Please read this form carefully, and ask any questions you may have before agreeing to take part in this survey.

What the study is about:

The intent of this study is to identify the most common information sources used by individuals to obtain production agricultural data and ultimately knowledge from various media forms.

What we will ask you to do:

If you agree to participate in this study, we will ask you to complete a pre-questionnaire, interact with the A.R.I.E.L. website and complete a post-questionnaire. The questionnaires will include questions about your knowledge of agricultural information, age, race, ethnicity, education, retention of agricultural knowledge presented, and suggestions for improving the presentation. The overall interaction and two questionnaires should approximately take 15 to 30 minutes to complete. Please find that you must be 18 years of age or older to participate in this research study.

Risks and Benefits:

Potential risk for this study is breach of confidentiality. The approach taken to minimize this risk will be in assigning codes during analysis and aggregating results to be used in any related reports/publications/presentations. There are no direct benefits to participating in this study.

Compensation:

There is no direct compensation for participating in this study.

Your answers will be confidential:

The records of this study will be kept private. In any sort of report we make public, we will not include any information that will make it possible to identify you. All data will be reported as group data. Research records will be kept in a

locked file; only the researchers will have access to the records. All data will be kept for a minimum of four years in accordance with the IRB regulation after the study is completed.

Taking part is voluntary:

Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with this study. If you decide to take part, you are free to withdraw at any time. Please let the investigator know that you are withdrawing by emailing them using the email addresses provided below.

If you have questions about the study or your Rights as a Research Participant:

The researchers conducting this study are Colton Atkins and Dr. Tracy Rutherford. Please ask any questions you have now. If you have questions later, you may contact Colton Atkins at coltonatkins07@gmail.com or at 979-219-0551. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at 979-458-4067 or access their website at http://rcb.tamu.edu/humansubjects. You may also report your concerns or complaints anonymously through Ethicspoint (https://secure.ethicspoint.com/domain/media/en/gui/20488/index.html) or by calling toll free at 1-866-297-0224. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

You may print a copy of this form to keep for your records.

Consent Form Life Span:

This consent form will be kept by the researcher for at least three years beyond the end of the study.

Print

I have read, understood, and printed a copy of, the above consent form and desire of my own free will to participate in this study.

- ◯ Yes
- ◯ No

My knowledge about the agricultural _____ industry is _____ compared to a non-agriculturally minded consumer (one who does not interact nor understand the industry chain of agriculture production).
(Please use items listed below to respond)

	Much Lower	Slightly Lower	About the Same	Higher	Much Higher
Livestock Production	◯	◯	◯	◯	◯
Crop Production	◯	◯	◯	◯	◯
Chemical, Pesticide and Fertilizer	◯	◯	◯	◯	◯

My knowledge about the _____ industry is _____ compared to a non-agriculturally minded individual (one who does not interact nor understand the industry chain of agriculture production).
(Please use items listed below to respond)

	Much Lower	Lower	About the Same	Higher	Much Higher
Beef Cattle	○	○	○	○	○
Dairy (Cattle)	○	○	○	○	○
Hog and Pig	○	○	○	○	○
Poultry and Egg	○	○	○	○	○
Aquaculture	○	○	○	○	○
Sheep and Goat (Meat, Wool or Dairy)	○	○	○	○	○
Other (Insects, Horses, Rabbits, etc.)	○	○	○	○	○

If other, please list below which industry you are knowledgable in.

My knowledge about the _____ industry is _____ compared to a non-agriculturally minded individual (one who does not interact nor understand the industry chain of agriculture production).
(Please use items listed below to respond)

	Much Lower	Lower	About the Same	Higher	Much Higher
Produce Crops (Grain, Vegetable, Fruit, etc.)	○	○	○	○	○
Greenhouse and Nursery	○	○	○	○	○
Forestry	○	○	○	○	○

I acquire knowledge about the beef cattle industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○

Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the beef cattle industry.

I acquire knowledge about the dairy cattle industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○

College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the dairy cattle industry.

I acquire knowledge about the hog and pig industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the hog and pig industry.

I acquire knowledge about the poultry and egg industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the poultry and egg industry.

I acquire knowledge about the aquaculture industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always

First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the aquaculture industry.

I acquire knowledge about the sheep and goat industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○

Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the sheep and goat industry.

I acquire knowledge about the (insect, horse, rabbit, etc.) industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the (insect, horse, rabbit, etc.) industry.

I acquire knowledge about the produce crops industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the produce crops industry.

I acquire knowledge about the greenhouse and nursery industry through _____.

(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the greenhouse and nursery industry.

I acquire knowledge about the forestry industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○

Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the forestry industry.

I acquire knowledge about the chemical, pesticide and fertilizer industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○

Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the chemical, pesticide and fertilizer industry.

In a typical month, I visit _____ for agricultural information.
(Please use items listed below on the left hand side to respond)

	Never	Once or Twice	Sometimes	Regularly	Very Often
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Extension Personnel	○	○	○	○	○
Family	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

I find obtaining information from _____ to be more pleasing than from other forms of media.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○

Television	○	○	○	○	○
Radio	○	○	○	○	○
Extension Personnel	○	○	○	○	○
Family	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

When I receive agricultural information, it is normally in a manner that is _____ towards promotion of the agriculture industry. (Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Positive	○	○	○	○	○
Negative	○	○	○	○	○

In the last 12 months, I attended more than one agricultural event pertaining to the _____ industry. (Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Beef Cattle	○	○	○	○	○
Dairy (Cattle)	○	○	○	○	○
Hog and Pig	○	○	○	○	○
Poultry and Egg	○	○	○	○	○
Aquaculture	○	○	○	○	○
Sheep and Goat (Meat, Wool or Dairy)	○	○	○	○	○
Other (Insects, Horses, Rabbits, etc.)	○	○	○	○	○

In the last 12 months, I attended more than one agricultural event pertaining to the _____ industry. (Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Produce Crops (Grain, Vegetable, Fruit, etc.)	○	○	○	○	○
Greenhouse and Nursery	○	○	○	○	○

Forestry	○	○	○	○	○

In the last 12 months, I attended more than one agricultural event pertaining to the _____ industry.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Chemical, Pesticide and Fertilizer	○	○	○	○	○

When I attended the agricultural event(s) I received take home information in the form of _____.
(Please use items listed below on the left hand side to respond)

	Never	Once or Twice	Sometimes	Regularly	Very Often
Pamphlets	○	○	○	○	○
Business Cards	○	○	○	○	○
Informational Sheets	○	○	○	○	○
Informational Cds	○	○	○	○	○
Books	○	○	○	○	○
Magazines	○	○	○	○	○
QR Codes	○	○	○	○	○

If none of the above, please explain what other forms of information you received.

When I purchase _____ products, I use my agricultural knowledge to make informed choices to purchase.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Beef Cattle	○	○	○	○	○
Dairy (Cattle)	○	○	○	○	○
Hog and Pig	○	○	○	○	○

Poultry and Egg	○	○	○	○	○
Aquaculture	○	○	○	○	○
Sheep and Goat (Meat, Wool or Dairy)	○	○	○	○	○
Other (Insect, Horse, Rabbit, etc.)	○	○	○	○	○
Produce Crops (Grain, Vegetable, Fruit, etc.)	○	○	○	○	○
Greenhouse and Nursery	○	○	○	○	○
Forestry	○	○	○	○	○
Chemical, Pesticide and Fertilizer	○	○	○	○	○

If you do not purchase some of the previous products, please list below which ones you do not purchase.

In utilizing the following comparisons, describe your beliefs about using new technology for gathering agricultural information.

Important	○ ○ ○ ○ ○ ○ ○	Unimportant
Relevant	○ ○ ○ ○ ○ ○ ○	Irrelevant
Exciting	○ ○ ○ ○ ○ ○ ○	Unexciting
Appealing	○ ○ ○ ○ ○ ○ ○	Unappealing
Worthless	○ ○ ○ ○ ○ ○ ○	Valuable
Not Needed	○ ○ ○ ○ ○ ○ ○	Needed

What is your gender?

- ○ Female
- ○ Male

How old are you?

- ◯ Under 18
- ◯ 18-25
- ◯ 26-34
- ◯ 35-54
- ◯ 55-64
- ◯ 65 or over

What is your race? (Select all that apply)

◯ White Only	◯ Black Only + 2 or more / 1 black	◯ 2 or More / Excluding Black
◯ American Indian Only	◯ Hispanic or Latino of any Race	◯ International
◯ Asian Only	◯ Native Hawaii Only	◯ Unknown or Not Reported

In what state do you currently reside?

Please indicate the highest level of education completed.

- ◯ Grammar School
- ◯ High School or equivalent
- ◯ Vocational/Technical School (2 year)
- ◯ Some College
- ◯ College Graduate (4 year)
- ◯ Master's Degree (MS)
- ◯ Doctoral Degree (PhD)
- ◯ Professional Degree (MD, JD, etc.)
- ◯ Other

Agricultural Occupation (Please select all that apply)

- [ ] Professional and Associate Professional
- [ ] Official and Manager
- [ ] Technician
- [ ] Administrative Support Worker
- [ ] Craft Worker
- [ ] Operative
- [ ] Laborer and Helper
- [ ] Sales Worker
- [ ] Service Worker
- [ ] Farmer and Rancher
- [ ] None of the Above

Please further describe, in a brief detailed statement, your agricultural occupation.

Agricultural Area of Occupation: Currently in (Please select all that apply)

- [ ] Beef Cattle
- [ ] Dairy (Cattle)
- [ ] Hog and Pig
- [ ] Poultry and Egg
- [ ] Aquaculture
- [ ] Sheep and Goat (Meat, Wool or Dairy)
- [ ] Other (Insect, Horse, Rabbit, etc.)
- [ ] Produce Crops (Grain, Vegetable, Fruit, etc.)
- [ ] Greenhouse and Nursery
- [ ] Forestry
- [ ] Chemical, Pesticide and Fertilizer

Do you own a ranch, farm or agriculturally related business?

- ◯ Yes
- ◯ No

In what state does your ranch, farm or agriculturally related business currently reside?

Agricultural Area of Business Owned: (Please select all that apply)

- ☐ Beef Cattle
- ☐ Dairy (Cattle)
- ☐ Hog and Pig
- ☐ Poultry and Egg
- ☐ Aquaculture
- ☐ Sheep and Goat (Meat, Wool or Dairy)
- ☐ Other (Insect, Horse, Rabbit, etc.)
- ☐ Produce Crops (Grain, Vegetable, Fruit, etc.)
- ☐ Greenhouse and Nursery
- ☐ Forestry
- ☐ Chemical, Pesticide and Fertilizer

Are you: (Please select all that apply)

- ☐ Full Time
- ☐ Part Time
- ☐ Retired
- ☐ Unemployed
- ☐ Graduate Student

C-2 Group Two Pre-Survey

A.R.I.E.L. Survey

A.R.I.E.L. Pre-Survey Questionnaire - Agriculture Group Two

Informed Consent Form

Introduction:

You are being asked to participate in a research study to identify knowledge levels compared to non-agriculturally minded individuals, commonly used information sources for knowledge acquisition, engagement with agricultural events and technology adoption characteristics. Individuals will use the Agricultural Resource Intelligent Educational Lecturer website. We are asking you to participate because you are an individual in a higher learning environment at Texas A&M University.

Please read this form carefully, and ask any questions you may have before agreeing to take part in this survey.

What the study is about:

The intent of this study is to identify the most common information sources used by individuals to obtain production agricultural data and ultimately knowledge from various media forms.

What we will ask you to do:

If you agree to participate in this study, we will ask you to complete a pre-questionnaire, interact with the A.R.I.E.L. website and complete a post-questionnaire. The questionnaires will include questions about your knowledge of agricultural information, age, race, ethnicity, education, retention of agricultural knowledge presented, and suggestions for improving the presentation. The overall interaction and two questionnaires should approximately take 15 to 30 minutes to complete. Please find that you must be 18 years of age or older to participate in this research study.

Risks and Benefits:

Potential risk for this study is breach of confidentiality. The approach taken to minimize this risk will be in assigning codes during analysis and aggregating results to be used in any related reports/publications/presentations. There are no direct benefits to participating in this study.

Compensation:

There is no direct compensation for participating in this study.

Your answers will be confidential:

The records of this study will be kept private. In any sort of report we make public, we will not include any information that will make it possible to identify you. All data will be reported as group data. Research records will be kept in a

locked file; only the researchers will have access to the records. All data will be kept for a minimum of four years in accordance with the IRB regulation after the study is completed.

Taking part is voluntary:

Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with this study. If you decide to take part, you are free to withdraw at any time. Please let the investigator know that you are withdrawing by emailing them using the email addresses provided below.

If you have questions about the study or your Rights as a Research Participant:

The researchers conducting this study are Colton Atkins and Dr. Tracy Rutherford. Please ask any questions you have now. If you have questions later, you may contact Colton Atkins at coltonatkins07@gmail.com or at 979-219-0551. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at 979-458-4067 or access their website at http://rcb.tamu.edu/humansubjects. You may also report your concerns or complaints anonymously through Ethicspoint (https://secure.ethicspoint.com/domain/media/en/gui/20488/index.html) or by calling toll free at 1-866-297-0224. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

You may print a copy of this form to keep for your records.

Consent Form Life Span:

This consent form will be kept by the researcher for at least three years beyond the end of the study.

Print

I have read, understood, and printed a copy of, the above consent form and desire of my own free will to participate in this study.

- ○ Yes
- ○ No

My knowledge about the agricultural _____ industry is _____ compared to a non-agriculturally minded consumer (one who does not interact nor understand the industry chain of agriculture production). (Please use items listed below to respond)

	Much Lower	Slightly Lower	About the Same	Higher	Much Higher
Livestock Production	○	○	○	○	○
Crop Production	○	○	○	○	○
Chemical, Pesticide and Fertilizer	○	○	○	○	○

My knowledge about the _____ industry is _____ compared to a non-agriculturally minded individual (one

who does not interact nor understand the industry chain of agriculture production).
(Please use items listed below to respond)

	Much Lower	Lower	About the Same	Higher	Much Higher
Beef Cattle	○	○	○	○	○
Dairy (Cattle)	○	○	○	○	○
Hog and Pig	○	○	○	○	○
Poultry and Egg	○	○	○	○	○
Aquaculture	○	○	○	○	○
Sheep and Goat (Meat, Wool/Mohair or Dairy)	○	○	○	○	○
Other (Insects, Horses, Rabbits, etc.)	○	○	○	○	○

If other, please list below which industry you are knowledgable in.

My knowledge about the _____ industry is _____ compared to a non-agriculturally minded individual (one who does not interact nor understand the industry chain of agriculture production).
(Please use items listed below to respond)

	Much Lower	Lower	About the Same	Higher	Much Higher
Produce Crops (Grain, Vegetable, Fruit, etc.)	○	○	○	○	○
Greenhouse and Nursery	○	○	○	○	○
Forestry	○	○	○	○	○

I acquire knowledge about the beef cattle industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○

Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the beef cattle industry.

I acquire knowledge about the dairy cattle industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○

College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the dairy cattle industry.

I acquire knowledge about the hog and pig industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the hog and pig industry.

I acquire knowledge about the poultry and egg industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the poultry and egg industry.

I acquire knowledge about the aquaculture industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always

First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the aquaculture industry.

I acquire knowledge about the sheep and goat industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○

Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the sheep and goat industry.

I acquire knowledge about the (insect, horse, rabbit, etc.) industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the (insect, horse, rabbit, etc.) industry.

I acquire knowledge about the produce crops industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the produce crops industry.

I acquire knowledge about the greenhouse and nursery industry through _____.

(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Family	○	○	○	○	○
Extension Personnel	○	○	○	○	○
College Course(s)	○	○	○	○	○
FFA Organization	○	○	○	○	○
4-H Organization	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the greenhouse and nursery industry.

I acquire knowledge about the forestry industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Websites and/or Blogs	○	○	○	○	○

Enewsletters					
Television					
Radio					
Family					
Extension Personnel					
College Course(s)					
FFA Organization					
4-H Organization					
Industry Specific Organizations					

If none of the above, please explain where you acquired most of your knowledge about the forestry industry.

I acquire knowledge about the chemical, pesticide and fertilizer industry through _____.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
First-hand Experience					
Books on my own					
Extension Papers					
Magazines					
Websites and/or Blogs					
Enewsletters					
Television					
Radio					
Family					
Extension Personnel					
College Course(s)					
FFA Organization					
4-H Organization					

Industry Specific Organizations	○	○	○	○	○

If none of the above, please explain where you acquired most of your knowledge about the chemical, pesticide and fertilizer industry.

In a typical month, I visit _____ for agricultural information.
(Please use items listed below on the left hand side to respond)

	Never	Once or Twice	Sometimes	Regularly	Very Often
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○
Television	○	○	○	○	○
Radio	○	○	○	○	○
Extension Personnel	○	○	○	○	○
Family	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

I find obtaining information from _____ to be more pleasing than from other forms of media.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Websites and/or Blogs	○	○	○	○	○
Enewsletters	○	○	○	○	○
Books on my own	○	○	○	○	○
Extension Papers	○	○	○	○	○
Magazines	○	○	○	○	○

Television	○	○	○	○	○
Radio	○	○	○	○	○
Extension Personnel	○	○	○	○	○
Family	○	○	○	○	○
Industry Specific Organizations	○	○	○	○	○

When I receive agricultural information, it is normally in a manner that is _____ towards promotion of the agriculture industry. (Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Positive	○	○	○	○	○
Negative	○	○	○	○	○

In the last 12 months, I attended more than one agricultural event pertaining to the _____ industry. (Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Beef Cattle	○	○	○	○	○
Dairy (Cattle)	○	○	○	○	○
Hog and Pig	○	○	○	○	○
Poultry and Egg	○	○	○	○	○
Aquaculture	○	○	○	○	○
Sheep and Goat (Meat, Wool/Mohair or Dairy)	○	○	○	○	○
Other (Insects, Horses, Rabbits, etc.)	○	○	○	○	○

In the last 12 months, I attended more than one agricultural event pertaining to the _____ industry. (Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Produce Crops (Grain, Vegetable, Fruit, etc.)	○	○	○	○	○
Greenhouse and Nursery	○	○	○	○	○

Forestry	○	○	○	○	○

In the last 12 months, I attended more than one agricultural event pertaining to the _____ industry.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Chemical, Pesticide and Fertilizer	○	○	○	○	○

When I attended the agricultural event(s) I received take home information in the form of _____.
(Please use items listed below on the left hand side to respond)

	Never	Once or Twice	Sometimes	Regularly	Very Often
Pamphlets	○	○	○	○	○
Business Cards	○	○	○	○	○
Informational Sheets	○	○	○	○	○
Informational Cds	○	○	○	○	○
Books	○	○	○	○	○
Magazines	○	○	○	○	○
QR Codes	○	○	○	○	○

If none of the above, please explain what other forms of information you received.

When I purchase _____ products, I use my agricultural knowledge to make informed choices to purchase.
(Please use items listed below on the left hand side to respond)

	Never	Seldom	Sometimes	Often	Almost Always
Beef Cattle	○	○	○	○	○
Dairy (Cattle)	○	○	○	○	○
Hog and Pig	○	○	○	○	○

Poultry and Egg	○	○	○	○	○
Aquaculture	○	○	○	○	○
Sheep and Goat (Meat, Wool/Mohair or Dairy)	○	○	○	○	○
Other (Insect, Horse, Rabbit, etc.)	○	○	○	○	○
Produce Crops (Grain, Vegetable, Fruit, etc.)	○	○	○	○	○
Greenhouse and Nursery	○	○	○	○	○
Forestry	○	○	○	○	○
Chemical, Pesticide and Fertilizer	○	○	○	○	○

If you do not purchase some of the products listed above, please list below which ones you do not purchase.

In utilizing the following comparisons, describe your beliefs about using new technology for gathering agricultural information.

Important	○ ○ ○ ○ ○ ○ ○	Unimportant
Relevant	○ ○ ○ ○ ○ ○ ○	Irrelevant
Exciting	○ ○ ○ ○ ○ ○ ○	Unexciting
Appealing	○ ○ ○ ○ ○ ○ ○	Unappealing
Worthless	○ ○ ○ ○ ○ ○ ○	Valuable
Not Needed	○ ○ ○ ○ ○ ○ ○	Needed

What is your gender?

- ○ Female
- ○ Male

How old are you?

- ◯ Under 18
- ◯ 18-25
- ◯ 26-34
- ◯ 35-54
- ◯ 55-64
- ◯ 65 or over

What is your race? (Select all that apply)

◯ White Only	◯ Black Only + 2 or more / 1 black	◯ 2 or More / Excluding Black
◯ American Indian Only	◯ Hispanic or Latino of any Race	◯ International
◯ Asian Only	◯ Native Hawaii Only	◯ Unknown or Not Reported

In what state do you currently reside?

Please indicate the highest level of education completed.

- ◯ Grammar School
- ◯ High School or equivalent
- ◯ Vocational/Technical School (2 year)
- ◯ Some College
- ◯ College Graduate (4 year)
- ◯ Master's Degree (MS)
- ◯ Doctoral Degree (PhD)
- ◯ Professional Degree (MD, JD, etc.)
- ◯ Other

Agricultural Occupation (Please select all that apply)

- [ ] Professional and Associate Professional
- [ ] Official and Manager
- [ ] Technician
- [ ] Administrative Support Worker
- [ ] Craft Worker
- [ ] Operative
- [ ] Laborer and Helper
- [ ] Sales Worker
- [ ] Service Worker
- [ ] Farmer and Rancher
- [ ] None of the Above

Please further describe, in a brief detailed statement, your agricultural occupation.

Agricultural Area of Occupation: Currently in (Please select all that apply)

- [ ] Beef Cattle
- [ ] Dairy (Cattle)
- [ ] Hog and Pig
- [ ] Poultry and Egg
- [ ] Aquaculture
- [ ] Sheep and Goat (Meat, Wool/Mohair or Dairy)
- [ ] Other (Insect, Horse, Rabbit, etc.)
- [ ] Produce Crops (Grain, Vegetable, Fruit, etc.)
- [ ] Greenhouse and Nursery
- [ ] Forestry

- [ ] Chemical, Pesticide and Fertilizer

Agricultural Area of Occupation: Planning to Enter (Please select all that apply)

- [ ] Beef Cattle
- [ ] Dairy (Cattle)
- [ ] Hog and Pig
- [ ] Poultry and Egg
- [ ] Aquaculture
- [ ] Sheep and Goat (Meat, Wool/Mohair and Dairy)
- [ ] Other (Insect, Horse, Rabbit, etc.)
- [ ] Produce Crops (Grain, Vegetable, Fruit, etc.)
- [ ] Greenhouse and Nursery
- [ ] Forestry
- [ ] Chemical, Pesticide and Fertilizer

Do you own a ranch, farm or agriculturally related business?

- ◯ Yes
- ◯ No

In what state does your ranch, farm or agriculturally related business currently reside?

Agricultural Area of Business Owned: (Please select all that apply)

- [ ] Beef Cattle
- [ ] Dairy (Cattle)
- [ ] Hog and Pig

- [ ] Poultry and Egg
- [ ] Aquaculture
- [ ] Sheep and Goat (Meat, Wool/Mohair or Dairy)
- [ ] Other (Insect, Horse, Rabbit, etc.)
- [ ] Produce Crops (Grain, Vegetable, Fruit, etc.)
- [ ] Greenhouse and Nursery
- [ ] Forestry
- [ ] Chemical, Pesticide and Fertilizer

Are you: (Please select all that apply)

- [ ] Full Time
- [ ] Part Time
- [ ] Retired
- [ ] Unemployed
- [ ] Student

C-3 Group One and Two Post Survey

A.R.I.E.L. Post-Survey

A.R.I.E.L. Post-Survey Questionnaire - Agriculture Group One

Informed Consent Form

Introduction:

You are being asked to participate in a research study to identify knowledge levels compared to non-agriculturally minded individuals, commonly used information sources for knowledge acquisition, engagement with agricultural events and technology adoption characteristics. Individuals will use the Agricultural Resource Intelligent Educational Lecturer website. We are asking you to participate because you are an individual with an agriculturally related occupation.

Please read this form carefully, and ask any questions you may have before agreeing to take part in this survey.

What the study is about:

The intent of this study is to identify the most common information sources used by individuals to obtain production agricultural data and ultimately knowledge from various media forms.

What we will ask you to do:

If you agree to participate in this study, we will ask you to complete a pre-questionnaire, interact with the A.R.I.E.L. website and complete a post-questionnaire. The questionnaires will include questions about your knowledge of agricultural information, age, race, ethnicity, education, retention of agricultural knowledge presented, and suggestions for improving the presentation. The overall interaction and two questionnaires should approximately take 15 to 30 minutes to complete. Please find that you must be 18 years of age or older to participate in this research study.

Risks and Benefits:

Potential risk for this study is breach of confidentiality. The approach taken to minimize this risk will be in assigning codes during analysis and aggregating results to be used in any related reports/publications/presentations. There are no direct benefits to participating in this study.

Compensation:

There is no direct compensation for participating in this study.

Your answers will be confidential:

The records of this study will be kept private. In any sort of report we make public, we will not include any information that will make it possible to identify you. All data will be reported as group data. Research records will be kept in a

locked file; only the researchers will have access to the records. All data will be kept for a minimum of four years in accordance with the IRB regulation after the study is completed.

Taking part is voluntary:

Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with this study. If you decide to take part, you are free to withdraw at any time. Please let the investigator know that you are withdrawing by emailing them using the email addresses provided below.

If you have questions about the study or your Rights as a Research Participant:

The researchers conducting this study are Colton Atkins and Dr. Tracy Rutherford. Please ask any questions you have now. If you have questions later, you may contact Colton Atkins at coltonatkins07@gmail.com or at 979-219-0551. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at 979-458-4067 or access their website at http://rcb.tamu.edu/humansubjects. You may also report your concerns or complaints anonymously through Ethicspoint (https://secure.ethicspoint.com/domain/media/en/gui/20488/index.html) or by calling toll free at 1-866-297-0224. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

You may print a copy of this form to keep for your records.

Consent Form Life Span:

This consent form will be kept by the researcher for at least three years beyond the end of the study.

Print

I have read, understood, and printed a copy of, the above consent form and desire of my own free will to participate in this study.

- ◯ Yes
- ◯ No

Browser Meta Info

This question will not be displayed to the recipient.
Browser:
Version:
Operating System:
Screen Resolution:
Flash Version:
Java Support:
User Agent:

After using the A.R.I.E.L. website, how confident are you in understanding agricultural industries and products such as _____? (Please use items listed below on the left hand side to respond)

	Not at All	Slightly	Moderately	Very	Extremely
Beef	○	○	○	○	○

If you answered not at all, please explain why.

With the information obtained from the A.R.I.E.L. website, how comfortable are you describing _____ to others about the information you learned? (Please use items listed below on the left hand side to respond)

	Not at All	Slightly	Moderately	Very	Extremely
Beef	○	○	○	○	○

If you answered not at all, please explain why.

Please indicate your agreement or disagreement with the following statement.

The A.R.I.E.L website was easy to navigate.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Please indicate your agreement or disagreement with the following statement.

The A.R.I.E.L. website was aesthetically pleasing.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please indicate your agreement or disagreement with the following statement.

The A.R.I.E.L. website provided information that was clearly communicated.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

If this website or a program with this information were available today in a grocery or food-related store, how likely would you be to use it?

Very Rarely	Rarely	Occasionally	Frequently	Very Frequently
○	○	○	○	○

If you are not likely to use it, why not?

Please indicate your agreement or disagreement with the following statement.

When I purchase food products, I would use my agricultural knowledge obtained through A.R.I.E.L. to make thorough decisions on what to purchase.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Overall, please indicate your satisfaction with your experience using the A.R.I.E.L. website.

Very Dissatisfied	Dissatisfied	Neither Satisfied or Dissatisfied	Satisfied	Very Satisfied
○	○	○	○	○

Please indicate your agreement or disagreement with the following statement.

The A.R.I.E.L. project will be helpful in providing information and knowledge about agriculture to individuals.

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Please explain your answer to the previous question.

In terms of usability, what did you like most about the A.R.I.E.L. website?

What changes would most improve our website?

In terms of content, what did you like most about the A.R.I.E.L. website?

Did someone help you complete this survey

No	Yes
○	○

How did that person help you? (Check all that apply)

- ☐ Read the questions to me
- ☐ Typed in the answers I gave
- ☐ Answered the questions for me
- ☐ Translated the questions if I did not comprehend
- ☐ Helped in some other way

If they helped you in some other way, please describe what they did.

APPENDIX D

IRB APPROVAL FORM

DIVISION OF RESEARCH

Office of Research Compliance

TEXAS A&M UNIVERSITY

APPROVAL DATE:	09/16/2013
MEMORANDUM	
TO:	Tracy Rutherford ALRSRCH - Agrilife Research - Ag Leadership, Education & Communication
FROM:	Dr. James Fluckey Chair Institutional Review Board
SUBJECT:	Submission Response for Initial Review Submission Form Approval

Protocol Number:	IRB2013-0299
Title:	Utilizing A.R.I.E.L., Agricultural Resources Intelligent Educational Lecturer, in the formational study of understanding before and after perceptions of Agricultural industry leaders and representational consumers in an applied convenience sampling.
Review Type:	Expedite
Approved:	09/16/2013
Continuing Review Due:	
Expiration Date:	09/15/2014
Documents Reviewed and Approved:	A.R.I.E.L. Consent Form (Correct) Students (English) Version 4.2; Information_Atkins_Version_4; Screenshot 1; Screenshot 2; Screenshot 3; Atkins_Class_Announce; reminder_letter_atkins - version 2; notice_letter_atkins - version 2; ARIEL Post-Survey (Students - Correct); ARIEL Pre-Survey (Students - Correct); ARIEL Post-Survey (Leaders - Correct); ARIEL Pre-Survey (Leaders - Correct)
; Document of Consent:	Partial waiver approved under 45 CFR 46.117 (c) 1 or 2/ 21 CFR 56.109 (c)1
Waiver of Consent:	

Provisions:	Signed consent for students was edited to remove reference to Agriculture leader participation. Recruitment announcement will be made in class for students who may participate in survey for one of multiple extra credit opportunities for class throughout the semester. If these students choose to participate, then their class will be documented on consent to communicate participation and earning of extra credit to their professor. Any student passing by who sees the display may also participate, but may not receive extra credit. Leaders will receive information sheet. Leaders approved for "Waiver of Documentation of Consent"

This research project has been approved. As principal investigator, you assume the following responsibilities

1. **Continuing Review:** The protocol must be renewed by the expiration date in order to continue with the

750 Agronomy Road, Suite 2701
1186 TAMU
College Station, TX 77843-1186

Tel. 979.458.1467 Fax. 979.862.3176
http://rcb.tamu.edu